Class-XII Session 2022-23
Subject - Biology (044)
Sample Question Paper - 23
With Solution

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Ch. No.	Title	Marks Per Unit	Section-A (1 marks)	Section-B (2 marks)	Section-C (3 marks)	Section-D (4 marks)	Section-E (5 marks)	Total Marks
			MCQ & A/R Ques. No.	VSA Ques. No.	SA Ques. No.	Case based Ques. No.	LA Ques. No.	
1	Reproduction in organisms	16	1(Q3)					1
2	Sexual Reproduction in Flowering Plants		1(Q9)		1(Q22)		1(Q33)	9
3	Human Reproduction		1(Q13)	1(Q17)				3
4	Reproductive Health		1(Q14)	1(Q18)				3
5	Principles of Inheritance and Variation	20	4(Q1, 7, 8, 16)		1(Q26)			7
6	Molecular Basis of Inheritance		3(Q5, 11, 12)				1(Q32)	8
7	Evolution		2(Q6, 10)		1(Q27)			5
8	Human Health and Disease	12		1(Q19)	1(Q23)			5
9	Strategies for enhancement in food production		1(Q15)					1
10	Microbes in Human Welfare			1(Q20)		1(Q29)		6
11	Biotechnology-Principles and Processes	12	2(Q2, 4)		1(Q24)			5
12	Biotechnology and its Application				1(Q28)	1(Q30)		7
13	Organisms and Populations	10		1(Q21)				2
14	Ecosystem							0
15	Biodiversity and conservation				1(Q25)		1(Q31)	8
16	Environmental issues							0
	Total Marks (Total Questions)		16(16)	10(5)	21(7)	8(2)	15(3)	70(33)

NOTE: The number given inside the bracket denotes question number, ask in the sample paper, while the number given outside the bracket are the number of questions from that particular chapter.

Time Allowed : 3 Hours **Max. Marks : 70**

General Instructions

1. All questions are compulsory.
2. The question paper has five sections and 33 questions. All questions are compulsory.
3. Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section–C has 7 questions of 3 marks each: Section–D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 marks each.
4. There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
5. Wherever necessary, neat and properly labeled diagrams should be drawn.

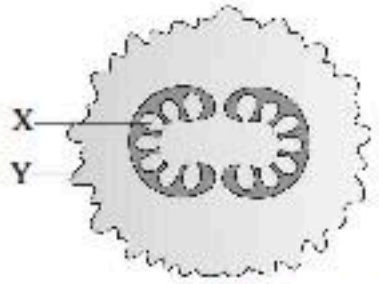
SECTION-A

1. A girl has blood group A and her brother has blood group B. Which combination of genotypes cannot belong to their parents?

	Mother	Father
(a)	I^AI^A	I^BI^O
(b)	I^AI^B	I^AI^B
(c)	I^OI^O	I^AI^B
(d)	I^BI^O	I^AI^O

2. The colonies of recombinant bacteria appear white in contrast to blue colonies of non-recombinant bateria because of:
(a) Insertional inactivate of alphaga-lactosidase in non-recombinant bacteria
(b) Insertional inactivation of alpha-galactosidase in recombinant bacteria
(c) Inactivation of glycosidase enzyme in recombinant bacteria
(d) Non-recombinant bacteria containing beta-galactosidase

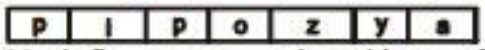
3. Which of the labelled parts (X and Y) in the transverse section of pea plant is/are diploid?



(a) X (b) Y (c) Both X and Y (d) None of these

4. In agarose gel electrophoresis
(a) DNA migrates towards the negative electrode. (b) supercoiled plamids migrate slower than their nicked counterparts.
(c) larger molecules migrate faster than smaller molecules. (d) ethidium bromide can be used to visualize the DNA.

5. In the Diagram given figure of Lac operon



(a) i– Repressor, z– -galactosidase, y– Permease, a–Transacetylase
(b) i– Inhibitor, z– Repressor, y– Transacetylase, a– Permease
(c) i– Inducer, z– -galactosidase, y– Permease, a– Repressor
(d) i– -galactosidase, z– Repressor, y– Permease, a– Transacetylase

6. The given diagram of marsupials of Australia provides an example of

(a) convergent evolution (b) parallel evolution
(c) recapitulation (d) divergent evolution

7. The 'X' body of Henking was observed in
   (a) all sperms during spermatogenesis. (b) all eggs during oogenesis.
   (c) half of the sperms during spermatogenesis. (d) half of the eggs during oogenesis.
8. The gene disorder phenylketonuria is an example for
   (a) multiple allelism (b) polygenic inheritance (c) multiple factor (d) pleiotropy
9. Pollination by water occurs in
   (a) Vallisneria (b) Zostera (c) Hydrilla (d) All of these
10. Single step large mutation leading to speciation is also called:
   (a) Founder effect (b) saltation (c) branching descent (d) natural selection
11. Human Genome Project (HGP) is closely associated with the rapid development of a new area in biology called as
   (a) biotechnology (b) bioinformatics (c) biogeography (d) bioscience
12. Which process is used for amplication or multiplication of DNA for finger printing?
   (a) polymerse chain reaction (PCR) (b) nesslerisation
   (c) southern blotting (d) northern blotting

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

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

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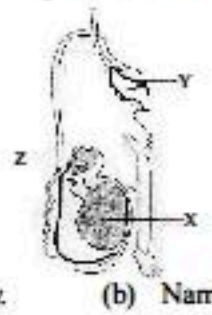
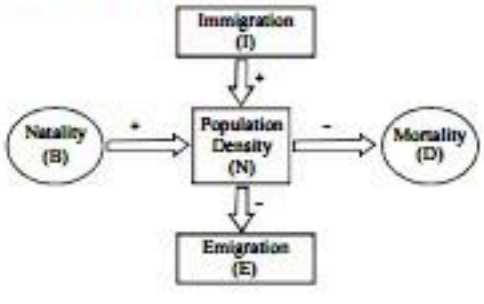
13. **Assertion:** During fertilisation, acrosome help the sperm enter into the cytoplasm through zona pellucida.
   Reason: If several spermatozoa hit the egg at same time, all can enter the egg.
14. **Assertion:** Copper-T is an effective contraceptive device in human females.
   Reason: Copper-T prevents passage of sperms from vagina upwards into the fallopian tubes.
15. **Assertion:** In plant tissue culture, somatic embryos can be induced from any plant cell.
   Reason: Any viable plant cell can differentiate into somatic embryos.
16. **Assertion:** In honey bee drone have 16 chromosomes while queen has 32 numbers of chromosomes.
   Reason: Male bees develop from unfertilised egg and female bees from fertilised eggs.

SECTION-B

17. The given diagram shows human male reproductive system (one side only) with few parts labelled as X, Y and Z.



   (a) Identify 'X' and write its location in the body. (b) Name the accessory gland 'Y' and its secretion.
   (c) Name and state the function of Z.
18. A woman has certain queries as listed below, before starting with contraceptive pills. Answer them.
   (a) What do contraceptive pills contain and how do they act as contraceptives ?
   (b) What schedule should be followed for taking these pills ?
19. Name any two secondary lymphoid organs in a human body and state the function of anyone of them.
20. (a) A patient who had an organ transplant was given cyclosporine – A. Mention its microbial source and state the reason for administration of this bioactive molecule.
   (b) Bottled fruit juices bought from the market are clearer as compared to those made at home. Give reason.
21. Refer the figure of population density and answer the questions.



(a) Which of the above represents the increase or decrease of population?
(b) If N is the population density at time t, then what would be its density at time $(t+1)$? Give the formula.
(c) In a barn there were 30 rats. 5 more rats enter the barn and 6 out of the total rats were eaten by the cats. If 8 rats were born during the time period under consideration and 7 rats left the barn, find out the resultant population at time $(t+1)$.
(d) If a new habitat is just being colonized, out of the four factors affecting the population growth which factor contriburtes the most?

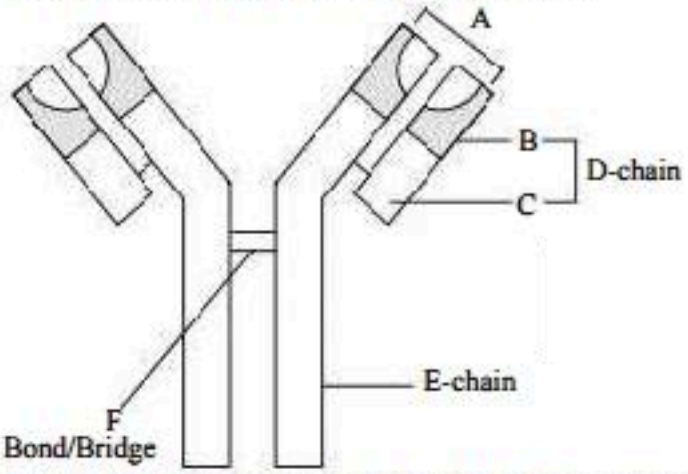
SECTION-C

22. (a) Draw the diagram of a pistil where pollination has successfully occurred. Label the parts involved in reaching the male gametes to its desired destination.
(b) Why is sporopollenin considered the most resistant material?

23. Write the scientific names of the casual organisms of elephantiasis and ringworm in humans. Mention the body parts affected by them.

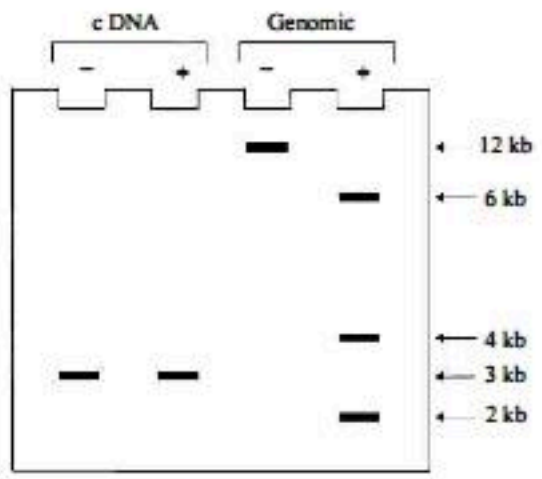
OR

(a) Identify A, D, E and F in the diagram of an antibody molecule given below:



(b) Why is the structure of an antibody molecule represented as H_2L_2? Name any two types of antibodies produced in a human body.

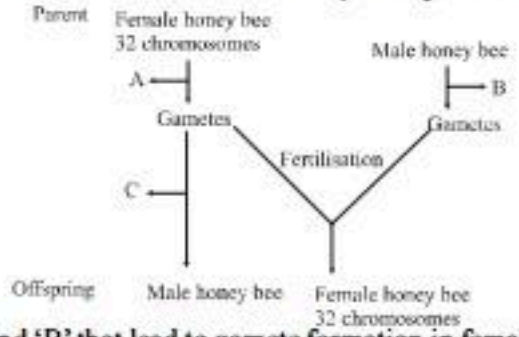
24. (a) A researcher prepared cDNA clones and genomic DNA clones of a particular gene. She then isolated DNA from both these clones and completely digested them with *Eco*RI. The digests were analysed by gel electrophoresis followed by hybridisation using probes specific for that particular gene. Following are the results obtained after autoradiography. ('+' indicates the addition of restriction enzyme and '–' indicates absence of the enzyme.) Study the results and write down two interpretations from this.



(b) How can one visualise DNA on an agarose gel?

25. (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 levels of biological organisation.

26. The cytological observations made in a number of insects led to the development of the concept of genetic/chromosomal basis of sex-determination mechanism. Honey bee is an interesting example to study the mechanism of sex-determination. Study the schematic cross between the male and the female honey bees given below and answer the questions that follow:



(a) Identify the cell divisions 'A" and 'B' that lead to gamete formation in female and male honey bees respectively.
(b) Name the process 'C' that leads to the development of male honey bee (drone).

27. (a) Differentiate between analogous and homologous structures.
(b) Select and write analogous structures from the list given below:
(i) Wings of butterfly and birds (ii) Vertebrate hearts
(iii) Tendrils of *Bougainvillea* and *Cucurbita* (iv) Tubers of sweet potato and potato

28. (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.

SECTION-D

29. Read the following and answer any four questions from 29(i) to 29(iv) given below:

Sewage Treatment:

Primary treatment : These treatment steps basically involve physical removal of particles - large and small - from the sewage through filtration and sedimentation. These are removed in stages; initially, floating debris is removed by sequential filtration. Then the grit (soil and small pebbles) are removed by sedimentation. All solids that settle form the primary sludge, and the supernatant forms the effluent. The effluent from the primary settling tank is taken for secondary treatment.

Secondary treatment or Biological treatment: The primary effluent is passed into large aeration tanks where it is constantly agitated mechanically and air is pumped into it. This allows vigorous growth of useful aerobic microbes into flocs (masses of bacteria associated with fungal filaments to form mesh like structures). While growing, these microbes consume the major part of the organic matter in the effluent. This significantly reduces the BOD (biochemical oxygen demand) of the effluent. BOD refers to the amount of the oxygen that would be consumed if all the organic matter in one liter of water were oxidised by bacteria. The sewage water is treated till the BOD is reduced. The BOD test measures the rate of uptake of oxygen by micro-organisms in a sample of water and thus, indirectly, BOD is a measure of the organic matter present in the water. The greater the BOD of waste water, more is its polluting potential. Once the BOD of sewage or waste water is reduced significantly, the effluent is then passed into a settling tank where the bacterial 'flocs' are allowed to sediment. This sediment is called **activated sludge**. A small part of the activated sludge is pumped back into the aeration tank to serve as the inoculum. The remaining major part of the sludge is pumped into large tanks called anaerobic sludge digesters. Here, other kinds of bacteria, which grow anaerobically, digest the bacteria and the fungi in the sludge. During this digestion, bacteria produce a mixture of gases such as methane, hydrogen sulphide and carbon dioxide. These gases form biogas and can be used as source of energy as it is inflammable.

(i) Which gas is mainly produced by the activity of anaerobic bacteria on sewage treatment?
(ii) Druing which stage of the purification of the sewage water are microbes used?
(iii) What does a high value of BOD(Biochemical Oxygen Demand) indicate?
(iv) During digestion, which gases produced by bacteria?

30. Read the following and answer any four questions from 30(i) to 30(iv) given below:

Gene Therapy:

Gene therapy is a collection of methods that allows correction of a gene defect that has been diagnosed in a child/embryo. Here genes are inserted into a person's cells and tissues to treat a disease. Correction of a genetic defect involves delivery of a normal gene into the individual or embryo to take over the function of and compensate for the non-functional gene. The first clinical gene therapy was given in 1990 to a 4-year old girl with adenosine deaminase (ADA) deficiency. This enzyme is crucial for the immune system to function. The disorder is caused due to the deletion of the gene for adenosine deaminase. In some children ADA deficiency can be cured by bone marrow transplantation; in others it can be treated by enzyme replacement therapy, in which functional ADA is given to the patient by injection. But the problem with both of these approaches that they are not completely curative. As a first step towards gene therapy, lymphocytes from the blood of the patient are grown in a culture outside the body. A functional ADA cDNA (using a retroviral vector) is then introduced into these lymphocytes, which are subsequently returned to the patient. However, as these cells are not immortal, the patient requires periodic infusion of such genetically engineered lymphocytes. However, if the gene isolate from marrow cells producing ADA is introduced into cells at early embryonic stages, it could be a permanent cure.

(i) Name the enzyme deficiency found in 4 years old girl?
(ii) What is Gene therapy?
(iii) Which therapy introduce the remedial gene to bone marrow cells?
(iv) If the gene isolate from marrow cell producing ADA, cell will be introduced at which stage?

SECTION-E

31. In 1998, the Rajasthan high court charges against bollywood superstar Salman Khan and several other actor linked to the Black shooting case during the shooting of the film "Hum saath saath hai" and has finalized the charges pressed against the actors. It's reported that the actor is likely to face a jail sentence upto 3 years or a fine or both. Salman will be held under section of 51 of wildlife Act and section 149 of Indian penal code (IPC).
During the shooting of the film in 1998 in *Kankari* village near jodhpur, Rajasthan, Salman along with his co-stars were found guilty for killing a rare species.
(a) What values are displayed by Law and other management?
(b) Write a note on biodiversity conservation.
(c) How do religious beliefs help in the conservation of bidiversity
(d) What is anthropogenic extinction?

OR

A student in the Biology class brought this fact-Greenland has only 56 species while India has 1200 species of plants and animals. The teacher asked the students to think for a valid reason but the students could not.
(a) What is the possible reason behind this?
(b) What are the three hypothesis proposed to explain the difference in biodiversity?
(c) What are your duties towards conservation of this rich heritage?

32. What is criss-cross inheritance? Name its different types. Give its importance.

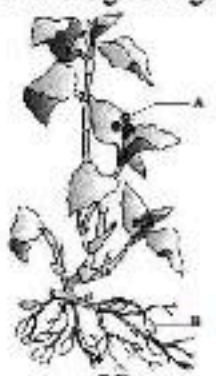
OR

In a fight between a thief and an owner of a jewellery shop, the thief got injured but somehow managed to escape. The owner lodged a police complaint. The police collected some blood samples from the scene of crime.
(a) Can the police identify the thief from the blood sample? Name the technique used in this.
(b) Describe the technique.
(c) Indicate the value such technique to human.

33. (a) Given below are the events that are observed in an artificial hybridisation programme. Define artificial hybridisation. Arrange the events in the correct sequential order. Which step in the hybridisation programme is done to prevent contamination of stigma with unwanted pollen grains?

(i) Rebagging	(ii) Selection of parent
(iii) Bagging	(iv) Dusting the pollen on stigma
(v) Emasculation	(vi) Collection of pollen from male parent.

(b) Identify the type of flower marked as 'A' and 'B' in the given figure. Which out of the two will produce an assured seed set?



OR

Answer the following questions by referring the given figures which illustrates the sequences of ovarian events (i - ix) in a human female.

(i) (ii) (iii) (iv) (v) (vi) (vii) (viii) (ix)

(a) Identify the figure that shows the process of ovulation and after which ovum moves into the fallopian tube and becomes available for fertilisation.
(b) Name the pituitary and ovarian hormone that have caused the above mentioned events.
(c) Identify the stage (vii) and briefly explain the changes that occur in the uterus simultaneously during this stage.

Solutions

SAMPLE PAPER-6

1. **(a)** If the mother has blood group IAIA and the father has blood group IBIO, then their children can only have genotypes IAIB or IAIO, which have the phenotypes blood group AB and blood group A respectively. (1 mark)
2. **(d)** (1 mark)
3. **(c)** Both X and Y are diploid in the given figure of transverse section of pea plant. (1 mark)
4. **(d)** Agarose gel electrophoresis plays a critical role in analysing DNA in laboratory experiments. It is a method of separating biological molecules by using an electrical current. Agarose gel electrophoresis provides a means of analysing DNA by separating molecules based on size. However, agarose gel electrophoresis does not provide a means of visualizing the DNA but that role is played by two dyes: ethidium bromide and loading buffer. Ethidium bromide, known as an intercalating agent. It allows to intercalate, or insert, between nitrogenous bases of a DNA molecule. When it is exposed to ultraviolet light, ethidium bromide fluoresces. Thus, this chemical provides both a means of tagging DNA molecules and a means of visualizing them. (1 mark)
5. **(a)** (1 mark)
6. **(d)** The given diagram of marsupials of Australia provides an example of divergent evolution. Divergent evolution is the accumulation of differences between groups which can lead to the formation of new species. It is usually due to diffusion of the same species to different and isolated environments which blocks the gene flow among the distinct populations allowing differentiated fixation of characteristics through genetic drift and natural selection. (1 mark)
7. **(c)** The X body of Henking was observed in half of the sperms during spermatogenesis. During his experiments on insects, Henking found the traces of a nuclear structure all through the process of spermatogenesis which he named it as X body. He also observed that, after spermatogenesis, exact half of the sperms received this X body, while the remaining half did not. Later, scientists found out that this X body of Henking was actually a chromosome and hence, named it X-chromosome. (1 mark)
8. **(d)** (1 mark)
9. **(d)** Pollination by water occurs in vallisneria & zostera. In vallisneria and Hydrilla, pollination takes place over the surface of water. In zostera, pollination takes place inside the surface of water. (1 mark)
10. **(b)** Hugo de Vries proposed mutation theory of evolution. He conducted some experiments on Oenothera lamarckiana (evening primrose) and believed that evolution takes place through mutation and not by minor variation and hence called it saltation (single step large mutation). (1 mark)
11. **(b)** Human Genome Project (HGP) is closely associated with the rapid development of a new area in biology called bioinformatics which is used for storage and analysis of enormous amount of data. (1 mark)
12. **(a)** Polymerase chain reaction (PCR) is a process used for the amplification (copy - small segments) of DNA. It is a technique for enzymatically replicating DNA without using living organisms, such as E. coli or yeast. It is commonly used in the medical and biological research labs for a variety of tasks, like detection of hereditary diseases, the identification of genetic fingerprints, diagnosis of infectious diseases, cloning of genes, paternity testing etc. (1 mark)
13. **(c)** Fertilisation is the fusion of male and female gametes to form zygote. During fertilisation, only head of the sperm enters the egg. After that polyspermy is avoided by fertilisation membrane. (1 mark)
14. **(c)** Intra-uterine device (IUD), Copper-T is plastic or metal object placed in the uterus by a doctor. Copper-T prevents the fertilisation of the egg or implantation of the embryo. (1 mark)
15. **(a)** Any living plant cell which is viable can be used to culture somatic embryos. These embryos have the characteristic features of the parent plant. The somatic cultures are viable from the stem, root, or leaves & the most viable part is the meristematic cell. (1 mark)
16. **(a)** The sex determination in honey bees is based on the number of sets of chromosomes an individual receives. An offspring formed from the union of a sperm and an egg develops as a female (i.e. queen or worker), and an unfertilised egg develops as a male (drone) using parthenogenesis. It means that males have half the number of chromosomes than that of a female. (1 mark)
17. (a) X is testicular lobules found in testis. The testes are located outside the abdominal cavity within a pouch like structure called 'scrotum'. (1 mark)
    (b) Y is seminal vesicle, an accessary gland. It produces an alkaline secretion called seminal fluid which forms 60-70% of semen by volume. (½ mark)
    (c) Z is epididymis. It stores sperm and secretes fluid containing the nutrients required for the maturation of spermatozoa. (½ mark)
18. (a) Contraceptives pills are small oral doses of either progesterone or progestrogen-ertrogen combinations. The pills inhibit ovulation and implantation as well as after the quality of cervical mucus to prevent/retard the entry of sperms. Thus, inhibit the pregnancy conditions.
    (b) The pills are taken daily for a period of 21 days starting preferably within the first five days of menstrual cycle. After a gap of 7 days (during which menstruation occurs) it has to be repeated in the same pattern till the female desires to prevent conception. (1 + 1 marks)
19. • Spleen, lymph nodes, tonsils, Peyer's patches of small intestine, vermiform appendix.
    They act as sites for interaction of lymphocytes with the antigen and cause immune response. (1 mark)
    • Function :
    (i) Spleen trap blood-borne micro-organisms and worn out RBCs, thus filters blood.
    (ii) Lymph nodes trap the microorganisms/antigens (which happen to get into the lymph and tissue fluid). The trapped antigens activate lymphocytes and cause immune response. (½ + ½ mark)

20. (a)
- Source of cyclosporine A – *Trichoderma polysporum.*
- Reason – It is an Immunosuppressive agent, used to prevent organ rejection. (½ + ½ mark)

(b) They are clarified by pectinases and proteases. (1 mark)

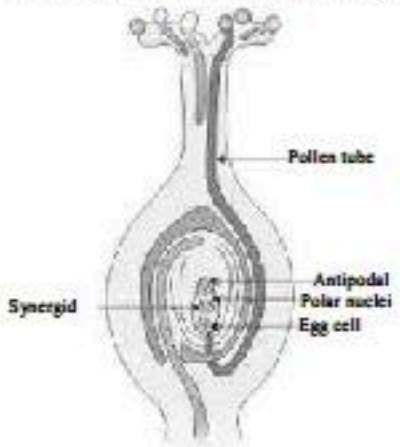
21. (a) Natality (B) and Immigration (I) represents increase of population and Emigration (E) and Mortality (D) represent decrease of population.

(b) $N_{t+1} = N_t + [(B + I) - (D + E)]$

(c) Here $N_t = 30$; $I = 5$; $E = 7$; $D = 6$; $B = 8$
Putting the value in the equation given below
$N_{t+1} = N_t + [(B + I) - (D + E)]$, we found that
$N_{t+1} = 30 + [(8 + 5) - (6 + 7)]$
$= 30 + [13 - 13] = 30 + 0 = 30$ rats

(d) Immigration contributes the most. (4 × ½ marks)

22. (a) Diagram with labelling stigma, pollen tube, synergids/ filiform apparatus, micropyle is given below:



(2 marks)

(b) Sporopollenin is considered to be the most resistant organic material because it is chemically very stable and can withstable high temperature, acidic and alkaline conditions and enzymes. (1 mark)

23. (i) **Elephantiasis** is caused by *Wuchereria bancrofti* and *W. malayi.* These affect lower limbs and genital organs. (1½ marks)

(ii) **Ringworm** is caused by *Microsporum, Trychophyton* and *Epidermophyton.* They affect the skin, nails and scalp. (1½ marks)

(1½ × 2 = 3 marks)

OR

(a) A – antigen binding site
B – variable region
C – constant region
D – light chain
E – heavy chain (constant region)
F – disulphide bond (½ × 4 = 1 mark)

(b)
- An antibody molecule (also known as immunoglobulin) is a type of Y-shaped tetrapeptide protein molecule. It is produced by B-lymphocytes in response to pathogens. It is represented as H_2L_2 because it is formed of two identical small heavy chain (represented by H) and two identical long light chains (represented by L). (1 mark)
- IgA, IgM, IgE, IgG (1 mark)

24. (a) (i) The cDNA clones lack *Eco*RI cleavage site.
(ii) The gene is a split gene and the *Eco*RI sites are present in the introns. (1 + 1 = 2 marks)

(b) A compound called ethidium bromide stains DNA, which on exposure with ultra-violet (UV) radiation gives orange light band of DNA. Hence, DNA fragments appear as orange band in the presence of ethidium bromide and UV light. (1 mark)

25. (a) Yes, India has greater ecosystem diversity than Norway. It is because Indian lies primarily in the tropical and sub-tropical zone while Norway lies near the Arctic region. This exposes the India to greater amounts of sunlight and thus greater level of ecosystem diversity. (1 mark)

(b) Difference between genetic diversity and species diversity:

S.No.	Genetic diversity	Species diversity
1.	It refers to the number of genes and their alleles found in organisms.	It refers to the number of species per unit area.
2.	It increases as we move up the biological organisation.	It may or may not increase to a greater extent as we move up the biological organisation.

(2 marks)

26. (a) 'A' Female honeybees are diploid so, the process of meiosis takes place for the gamete formation in female honeybees. While 'B' male honeybees are haploid so, mitosis takes place for the gamete formation in male honeybees.

(b) Honeybees are classified into three categories such as queen, drone and workers. So, the male honey bees are called drones. The male honey bees or drones are developed from the unfertilized female eggs and this phenomenon is called arrhenotoky. Arrhenotoky is a type of parthenogenesis in which unfertilized eggs are develop into males. (1½ + 1½ marks)

27. (a)

Homologous organs	Analogous organs
Similar in origin and basic structure but may differ in function.	Dissimilar in origin and basic structure but may have similar funciton.
Provide idea of common ancestry.	Do not provide the idea of common ancestry.
For E.g. hands of human beings and forelimbs of horse.	For E.g. wing of birds and insects.

(b) These are the analogous structure from the given list:
(i) Wings of butterfly and birds.
(ii) Tubers of sweet potato and potato.

(2 + 1 marks)

28. (a) Two limitations of traditional breeding that led to promotion of micropropaation are:
It failed to fulfill the demand.
It failed to provide an efficient and fast crop improvement system.

(b) Two advantages of micropropagation are:
Procuction of larger number of plants in very short duration of time 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. (1 + 1 + 1 marks)

29. (i) Marsh gas.
(ii) Secondary treatment.
(iii) It indicate that consumption of organic matter by microbes is higher in the water.
(iv) Methane, hydrogen sulphide and carbon dioxide. (1 + 1 + 1 + 1 marks)

30. (i) Adenosine deaminase.
(ii) Gene therapy is a collection of methods that allows correction of a gene defect that has been diagnosed in a child.
(iii) Somatic cell therapy.
(iv) At early embryonic stages, but it could be a permanent cure. (1 + 1 + 1 + 1 marks)

31. (a) Law and order is equal for every citizen. It shows principle of equality and social justice and also concerns for environmental and wild life conservation. (1 mark)

(b) Conserving and preserving the natural flora and fauna in its present form is called biodiversity conservation. Two approaches are taken for this purpose.
(i) *In situ conservation i.e.,* protecting the species in their natural places.
(ii) *Ex situ conservation i.e.,* protecting the species in an artificially created habitat away from its natural habitat and care afforded by man, *e.g.,* zoo, botanical gardens. (½ + ½ mark)

(c) Some plants are considered sacred and propagated for the religious ceremonies. In India, Tulsi, Pipal, Bargad, Mango, Deodar etc., are considered religious. Further, in some tribes, the forest itself is considered a form of God and propagated and protected by the tribes. Temples built by tribals are found surrounded by Deodar forests in Kumaon and Meghalaya. Not a single branch is allowed to be cut from these forests. Bishnois of Rajasthan protect black buck deer religiously. Some water bodies are also held sacred in certain places in Sikkim. Their aquatic flora and fauna are naturally preserved. (2 marks)

(d) It is the extinction abetted by human activities like settlement, hunting, over exploitation and habitat destruction. (1 mark)

OR

(a) Biodiversity is not uniform throughout the world but varies with latitude and altitude. The tropics harbour more species than temperate and polar regions. Greenland lies in temperate regions and India is a tropical country. Hence the difference. (1 mark)

(b) The hypothesis are as follows :—
I. Speciation is a function of time , while temperate regions were subjected to frequent glaciation in the past, the tropics have remained undisturbed and hence had evolved more species diversity.
II. As compared to temperate region, tropical environments are less seasonal, relatively more constant and predictable, such constant environments have promoted niche specialisation and greater species diversity.
III. There is more solar radiation available in the tropical region; this contributes directly to more productivity and indirectly to greater species diversity. (1 + 1 + 1 marks)

(c) As students we should work towards conservation of Biodiversity. Even if the species are of no economic value to us, they are of intrinsic value. We should prevent damage and over exploitation of forests. (1 mark)

32. Criss-cross inheritance is a type of sex-linked inheritance where a parent passes the sex-linked traits to the grandchild of the same sex through offspring of opposite sex. (1 mark)
It is of two types :-
(i) **Holandric :** From father to son *e.g.* hypertrichy, maleness.
(ii) **Hologenic :** From mother to daughter. (2 marks)
Importance :
(i) Traits showing criss-cross inheritance located on sex-chromosomes.
(ii) It proved that genes are located in the chromosomes.
(iii) Knowledge useful in knowing transmission of sex-linked disorders. (2 marks)

OR

(a) Yes, the police can identify the thief from the blood sample collected from the scene of crime by sending the sample to forensic labs for DNA fingerprinting. (1 mark)

(b) DNA fingerprinting involves identifying differences in some specific regions in DNA sequence called as repetitive DNA. These repeats vary in number from person to person and are inherited.
The technique involves the following steps:-
(i) Extraction –DNA is extracted from cells in a centrifuge
(ii) Amplification - Many copies of extracted DNA are made by polymerase chain reaction.
(iii) Restriction Digestion – DNA is cut into fragments with enzymes into precise sequences.
(iv) Separation of DNA sequences – The cut DNA fragments are passed though electrophoresis set up containing agarose gel and the separated fragments can be seen under UV radiation.
(v) Southern Blotting- The separated sequences are transferred onto a nylon membrane.
(vi) Hybridisation- The nylon membrane is immersed in a bath and radioactive probes are added.
(vii) Auto radiography- The membrane is pressed onto an X-ray film and dark bands develop the probe sites which resemble bar codes. (2 marks)

(c) This technique is of great value to humans. It can be used to:-
(i) To identify criminals in forensic lab
(ii) To determine real parents in cases of disputes
(iii) To verify whether an immigrant is really a close relative of the mentioned resident
(iv) To identify racial groups. (2 marks)

33. (a)
- Artificial hybridisation is the process in which only desired pollen grains are used for pollination & fertilisation. (1 mark)
- The correct sequence of the events observed in the artificial hybridisation is:
  (ii) Selection of parents
  (v) Emasculation (It is the removal of anthers from the flower bud before the anther dehisces. If the female parent produces unisexual flowers, there is no need of emasculation).
  (iii) Bagging (It is a process to cover the emasculated flower with a bag made up of butter paper).
  (vi) Collection of pollen from other male plant.
  (iv) Dusting of pollen on stigma.
  (i) Re-bagging (In this process, the stigma of the mature ovary is dusted with desired pollen grains and rebagged to allow the fruit to develop).
- Bagging is done to prevent contamination of its stigma with unwanted pollen grains. (2 marks)

(b)
- 'A' is chasmogamous flower having exposed anthers and stigma whereas B is cleistogamous flower which do not open at all.
- Cleistogamous flowers produce an assured seed set. (1 + 1 marks)

OR

(a) Figure (vi) illustrates the process of ovulation (release of ovum or secondary oocyte) and after which the ovum moves into the fallopian tube and becomes available for fertilisation. (1 mark)

(b) LH (luteinising hormone) from anterior pituitary gland and oestrogen from ovary are responsible for the events occur in the given figures. (1 mark)

(c)
- Figure (vii) represents the ovarian stage of developing corpus luteum that secretes progesterone along with small amounts of oestrogen which are essential for maintaining the pregnancy.
- The ovarian stage (vii) undergoes the luteal phase. Luteal phase is also called secretory phase (due to increased production of progesterone), during which the Graafian follicle transforms into the corpus luteum.
- Changes in uterus: Both the hormones (progesterone and oestrogen) maintain the thickened lining of the uterus for the implantation of blastocyst. Endometrium thickens and uterine gland becomes secretory. (3 × 1 = 3 marks)