SAMPLE QUESTION PAPER

BLUE PRINT

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

S. No.		Chapter	VSA /Case based/ AR (1 mark)	SA-I (2 marks)	SA-II (3 marks)	LA (5 marks)	Total	
1.	Unit-VI	Sexual Reproduction in Flowering Plants	3(3)	–	–	–	**3(3)**	**14**
2.		Human Reproduction	1(1)	1 + 1*(2)	–	1 + 1*(5)	**3(8)**	
3.		Reproductive Health	–	–	1(3)	–	**1(3)**	
4.	Unit-VII	Principles of Inheritance and Variation	2(2)	1(2)	2(6)	1 + 1*(5)	**6(15)**	**18**
5.		Molecular Basis of Inheritance	1(1)	1(2)	–	–	**2(3)**	
6.	Unit-VIII	Human Health and Diseases	1(4)	–	1(3)	1 + 1*(5)	**3(12)**	**14**
7.		Microbes in Human Welfare	–	1(2)	–	–	**1(2)**	
8.	Unit-IX	Biotechnology : Principles and Processes	2 + 1*(2)	2(4)	1*	–	**4(6)**	**12**
9.		Biotechnology and Its Applications	1(1)	1 + 1*(2)	1(3)	–	**3(6)**	
10.	Unit-X	Organisms and Populations	2(5)	1(2)	–	–	**3(7)**	**12**
11.		Biodiversity and Conservation	3(3)	1(2)	–	–	**4(5)**	
		Total	**16(22)**	**9(18)**	**5(15)**	**3(15)**	**33(70)**	

*It is a choice based question.

Subject Code : 044

BIOLOGY

Time allowed : 3 hours ***Maximum marks : 70***

General Instructions :

(i) All questions are compulsory.

(ii) The question paper has four sections: Section A, Section B, Section C and Section D. There are 33 questions in the question paper.

(iii) Section–A has 14 questions of 1 mark each and 02 case-based questions. Section–B has 9 questions of 2 marks each. Section–C has 5 questions of 3 marks each and Section–D has 3 questions of 5 marks each.

(iv) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.

(v) Wherever necessary, neat and properly labeled diagrams should be drawn.

SECTION - A

1. Differentiate between xenogamy and geitonogamy.

2. How pollen tablets are used by people these days?

3. How is apomixis different from parthenocarpy?

4. How does the sperm penetrate through the zona pellucida in human ovum?

5. Differentiate between dominance and co-dominance.

6. Differentiate between genetic and species diversity.

7. Name one animal which is extinct and one which is critically endangered.

8. How can retroviruses be used efficiently in biotechnology experiments inspite of them being disease causing?

9. Name some techniques that serve the purpose of early diagnosis of some bacterial/viral disease.

10. Mention any two ways in which Single Nucleotide Polymorphism (SNPs) identified in human genome can bring revolutionary change in biological and medical sciences.

11. **Assertion :** Male heterogamety is found in allosome complements ZW-ZZ and ZO-ZZ.
Reason : Female heterogamety occurs in allosome complements XX-XY and XX-XO.
(a) Both assertion and reason are true, and reason is the correct explanation of assertion.
(b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

12. **Assertion :** Vector DNA and foreign DNA are cut by same restriction endonuclease.
Reason : Digestion with same enzyme produces complementary sticky ends.
(a) Both assertion and reason are true, and reason is the correct explanation of assertion.
(b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

OR

Assertion : Amplification of a gene of interest can be done by polymerase chain reaction.
Reason : It is possible to amplify DNA segment approximately 1 billion times within a span of one day.
(a) Both assertion and reason are true, and reason is the correct explanation of assertion.
(b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

13. **Assertion :** Communities with more species tend to be more stable than those with less species.
Reason : Communities with more species is not able to resist occasional disturbance.
(a) Both assertion and reason are true, and reason is the correct explanation of assertion.
(b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

14. **Assertion :** Red soils are called laterite soils.
Reason : Red soils are formed through laterisation in which silica dissolves and leaches downwardly.
(a) Both assertion and reason are true, and reason is the correct explanation of assertion.
(b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.

15. **Read the following and answer any four questions from 15(i) to 15(v) given below:**
Rajat, a student of class 4^{th} has problem of sneezing, wheezing every year at a particular time period for no explained reason. Some people like Rajat are sensitive to some particles such as pollen, mites, etc., in the environment. This condition is called allergy. An allergy is a medical condition in which the body's immune system reacts abnormally to a foreign substance. The substance that causes the allergy is called an allergen. An allergen leads to the production of IgE type antibodies in the body. Allergens can be anything, like mites in dust, pollens, animal dander, etc. When a sensitive person comes in contact with an allergen, he starts suffering from symptoms like sneezing, watery eyes, running nose and difficulty in breathing. Allergy is due to the release of chemicals like histamine and serotonin from the mast cells. The cause of allergy is determined by exposing the patient to allergen or injected him with very small doses of possible allergens and the responses are studied. Drugs like anti-histamine, adrenaline and steroids quickly reduce the symptoms of allergy. Nowadays, people are more prone to allergies due to lesser immunity and more sensitivity to allergens due to modern life style. Low immunity leads to appearance of allergies and asthma in children of metro cities of India.

(i) The unexplained sneezing and wheezing at a particular time period of every year might be due to
(a) pollen (b) mushrooms (c) lactogen (d) fruits.

(ii) An allergen is
(a) a substance that can cause sneezing only
(b) a substance that can cause fever only
(c) a substance that can trigger the immune system.
(d) all foreign substances.

(iii) The effect of an allergen on a person is studied by

(a) exposing the person to allergen (b) injecting the allergen.
(c) oral dose of allergen (d) both (a) and (b).

(iv) Which of the following person would be more sensitive to pollens?

(a) Person having weak immune system (b) Person having hypersensitive skin
(c) Person having skin allergy (d) All of these

(v) **Assertion :** The symptoms sneezing, watery eyes, running nose and difficulty in breathing are associated with allergy.

Reason : Allergy is due to the release of chemicals like histamine and serotonin from the mast cells.

(a) Both assertion and reason are true, and the reason is the correct explanation of the assertion.
(b) Both assertion and reason are true, but the reason is not the correct explanation of the assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false

16. Read the following and answer any four questions from 16(i) to 16(v) given below:

In nature, if the resources are limited, there should be a competition between species to compete for the same resources. Competition is defined as a process in which the fitness of one species or intrinsic rate of increase is significantly lower in the presence of another species. Theoretically when the resources are limited the competitively superior species will eventually eliminate the other species. This was explained by Gause who gave a principle of competitive exclusion which states that two closely related species competing for the same resources cannot co-exist indefinitely and the competitively inferior one will be eliminated eventually. This may be true if resources are limiting, but not otherwise. In nature such competitive exclusion are not always evident. The species facing competition might evolve mechanisms that promote co-existence rather than exclusion. One such mechanism is 'resource partitioning'. If two species compete for the same resource, they could avoid competition by choosing, for instance, different times for feeding or different foraging patterns. MacArthur showed that five closely related species of warblers living on the same tree were able to avoid competition and co-exist due to behavioural differences in their foraging activities.

(i) According to the principle of competitive exclusion, if two closely related species compete for same resource then

(a) superior species get eliminated (b) inferior species get eliminated
(c) resource partitioning take place (d) coexistence would occur.

(ii) Competition is studied in terms of _____.

(a) adaptations (b) intrinsic rate of increase
(c) efficiency (d) none of these

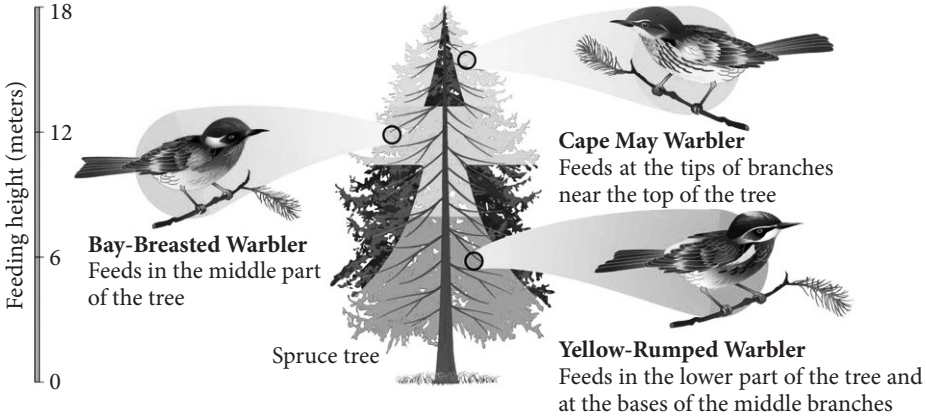
(iii) The island of Puerto Rico is the abode for a large number of anole lizards. They evolved over time due to natural selection and differentiated into 11 species that use different resources and live in different habitats. It is an example of _____.

(a) competitive exclusion (b) resource partitioning
(c) competitive spread (d) efficiency

(iv) If the resources are limited, two closely resources can coexist only if

(a) major member of inferior species get eliminated
(b) major member of superior species get eliminated
(c) resource partitioning occurs
(d) none of these.

(v) Refer to the given figure.



The following statements are drawn as conclusions from the above figure .

I. This is an example of resource partitioning.

II. This is an example of competitive exclusion.

III. It is an example of mutualism.

Choose from below the correct alternative.

(a) Only I is true.
(b) I and II are true.
(c) III and II are true.
(d) I, II and III are true.

SECTION - B

17. Name the stage of the human embryo that gets implanted in the uterus and draw its labelled diagram.

OR

Mention the number of cells in the following stages.

S.No.	Embryonic stage	No. of cells
(i)	Zygote	(X)
(ii)	Morula	(Y)
(iii)	Blastocyst	(Z)

18. Tallness of pea plant is a dominant trait, while dwarfness is the alternate recessive trait. When a pure-line tall is crossed with pure-line dwarf, what fraction of tall plant in F_2 shall be heterozygous? Give reasons.

19. Explain the different steps involved during primary treatment phase of sewage.

20. DNA being hydrophilic cannot pass through the cell membranes of a host cell. Explain how does recombinant DNA get introduced into the host cell to transform the latter.

21. How is gene therapy being used in treating ADA deficient patients?

22. The transformed cells are selected with the help of selectable marker genes incorporated into the vector. Explain following methods adopted for this purpose:

(i) Selection by resistance to antibiotics
(ii) Blue white screening
(iii) Colony hybridisation

OR

Explain how *Agrobacterium tumefaciens* is used by researchers as a cloning vector to transfer DNA to plant cells.

23. Explain the relationship between species richness and area with the help of graph.

24. One of the salient features of the genetic code is that it is nearly universal from bacteria to humans. Mention two exceptions to this rule. Why are some codes said to be degenerate?

25. Discuss brood parasitism in birds.

SECTION - C

26. An infertile couple is advised to adopt test-tube baby programme. Describe two principle procedures adopted for such technologies.

27. Why is the possibility of a human female suffering from haemophilia rare ? Explain.

28. In a cross between two tall pea plants some of the offspring produced were dwarf. Show with the help of Punnett square how this is possible.

29. **(a)** Name the bacterium which produces Bt toxin. What is the significance of this toxin?

(b) Name the gene which codes for this toxin. Why this toxin does not kill the bacterium?

(c) Name the genes that prevent infection by cotton bollworms and corn borers in pest resistant plants.

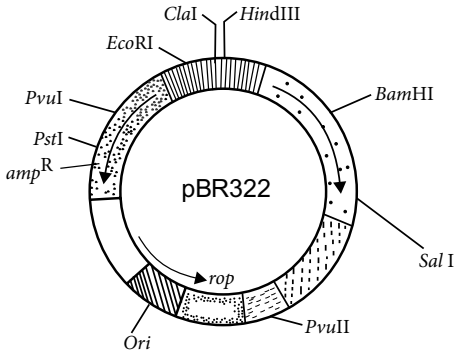
OR

Refer to the given figure and answer the following questions.

(i) Name the organism in which the vector is inserted to get the copies of the desired gene.

(ii) Mention the area labelled in the vector responsible for controlling the copy number of the inserted gene.

(iii) Name and explain the role of a selectable marker shown in the vector.



30. **(a)** Name and explain giving reasons, the type of immunity provided to the newborn by the colostrum and vaccinations.

(b) Name the type of antibody:

(i) present in colostrum

(ii) produced in response to allergens in human body.

SECTION - D

31. **(a)** Draw a transverse section of human ovary showing the sequential development of different follicles up to the corpus luteum.

(b) Comment on the corresponding ovarian and pituitary hormone levels during these events.

OR

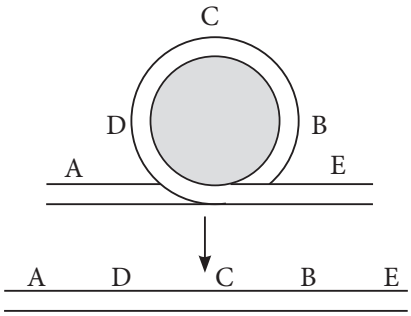
(a) Draw a labelled diagrammatic view of human male reproductive system.

(b) Differentiate between :

(i) Vas deferens and vasa efferentia

(ii) Spermatogenesis and spermiogenesis

32. Refer to the given figure and answer the following questions.



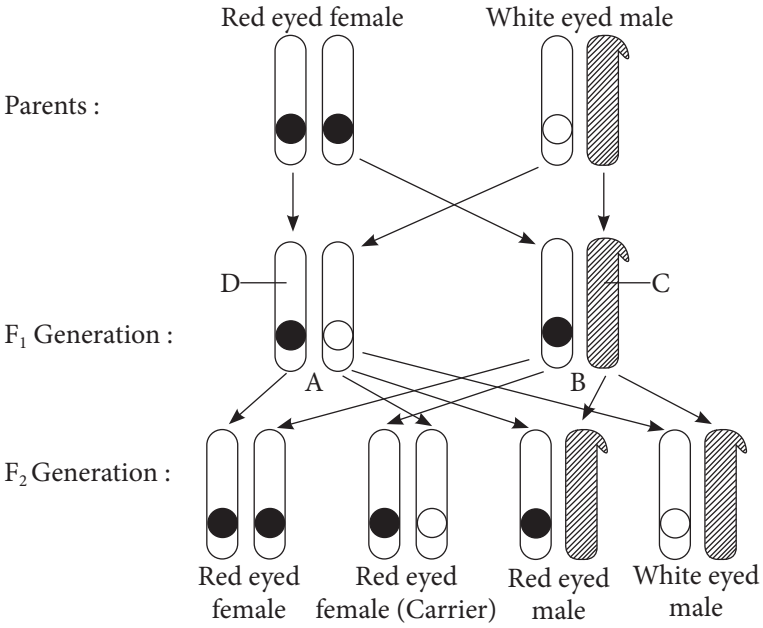
(i) Which phenomenon is represented by the given figure?

(ii) Explain the subtype of the phenomenon by assuming 'C' as the point of centromere.

(iii) What is the effect of this phenomenon on crossing over and sterility?

OR

Study the given figure and answer the following questions.



(i) Identify A, B, C and D from the given figure.

(ii) What kind of inheritance is shown by the figure?

(iii) State the significance of this inheritance.

33. Describe the asexual and sexual phases of life cycle of *Plasmodium* that cause malaria in humans.

OR

Write a note on cancer.

SOLUTIONS

1. Differences between xenogamy and geitonogamy are as follows:

S.No.	Xenogamy	Geitonogamy
(i)	It is pollination between two flowers of different plants.	It is pollination between two flowers of the same plant.
(ii)	The flowers are genetically different.	The flowers are genetically similar.
(iii)	It is genetically cross pollination.	It is genetically self pollination.

2. Pollen tablets are used as food supplement by people to improve health.

3. Apomixis is a mode of reproduction which does not involve formation of zygote through gametic fusion whereas parthenocarpy involves formation of zygote through gametic fusion but produces seedless fruits. Apomixis produces seeds without fertilisation *e.g.*, some species of Asteraceae and grasses. Parthenocarpy is production and development of seedless fruits, *e.g.*, banana, grapes.

4. The sperms penetrate through the zona pellucida by releasing sperm lysins.

5. Differences between dominance and co-dominance are :

S.No.	Dominance	Co-dominance
(i)	The effect of dominant allele is conspicuous.	The effect of both the alleles is equally conspicuous.
(ii)	Dominant allele produces its effect even in the presence of recessive allele.	Both the alleles produce their effect independently.

6. The differences between genetic diversity and species diversity are as follows:

S.No.	Genetic diversity	Species diversity
(i)	It is related to number of genes and their alleles found in organisms.	It is related to number and distribution of species found in an area.
(ii)	It is trait of the species.	It is trait of the community.
(iii)	It influences adaptability and distribution of a species in diverse habitats.	It influences biotic interactions and stability of the community.

7. Extinct – Dodo
Critically endangered - Pigmy Hog

8. Retroviruses are first disarmed (disease causing gene is removed/inactivated), this disarmed virus do not cause disease and hence are used to transfer desirable genes into host cells. So, inspite of them being disease causing, it (disarmed retrovirus) is used efficiently in biotechnology experiments.

9. Recombinant DNA technology, polymerase chain reaction (PCR) and enzyme linked immunosorbent assay (ELISA) are the some of the techniques that serve the purpose of early diagnosis of bacterial/viral diseases.

10. (i) In finding chromosomal locations for disease associated sequences
(ii) In tracing human history

11. (d) : Female heterogamety is found in allosome complements ZW-ZZ and ZO – ZZ. Male heterogamety occurs in allosome complements XX – XY and XX-XO.

12. (a) : The vector DNA and foreign DNA carrying gene of interest are cut by the same restriction endonuclease to produce complementary sticky ends. This process of cutting DNA by restriction enzyme is called restriction digestion.

OR

(b) : The polymerase chain reaction results in the selective amplification of a specific region of a DNA molecule and so can also be used to generate a DNA fragment for cloning.

13. (c) : Communities with more species tend to be more stable than those with less species. It is able to resist occasional disturbance.

14. (a)

15. (i) (a) : Seasonal allergies, sometimes called "hay fever" or seasonal allergic rhinitis, are allergy symptoms that happen during certain times of the year, usually when outdoor molds release their spores and trees, grasses and weeds release tiny pollen particles into the air to fertilise other plants.

(ii) (c) : An allergen is usually a harmless substance capable of triggering a response that starts in the immune system and results in an allergic reaction.

(iii) (d) : The cause of allergy is determined by exposing the patient to allergen or injected him with very small doses of possible allergens, and the responses are studied. Even though a food allergy test such as mushroom is performed by injecting a minute amount of the mushroom protein into the skin. If any inflammation or redness is observed, the patient is tested positive for mushroom allergy.

(iv) (a) : The person having weak immune system is more prone to allergies.

(v) (b)

16. (i) (b) : The principle of competitive exclusion was proposed by G.F. Gause which states that two species competing for the same resources cannot coexist. This law is also known as Gause's law. According to this law, one superior population will drive off the other one. If any of the members of the depleted population remains, that would be because they have adapted themselves according to the different niche.

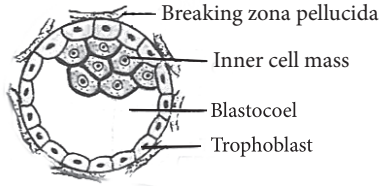
(ii) (b) : Competition is defined as a process in which the fitness of one species or intrinsic rate of increase is significantly lower in the presence of another species.

(iii) (b) : If one or both the species belonging to the same niche evolve to use different resources or develop different feeding habits, competitive exclusion can be avoided. Due to this evolution, the species start using non-overlapping resources resulting in different niches. This is termed a resource partitioning. This helps the species to exist together.

(iv) (c) : *Refer to answer 16(iii).*

(v) (b) : The competitive exclusion principle says that two species can not coexist if they occupy exactly the same niche (competing for identical resources). Two species whose niches overlap may evolve by natural selection to have more distinct niches, resulting in resource partitioning.

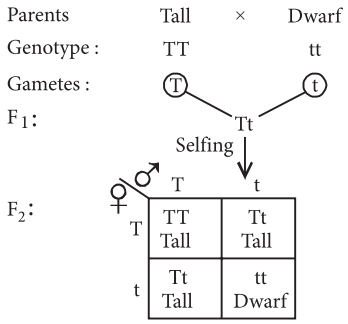
17. Blastocyst gets implanted in the uterus.



OR

(i) 1 (ii) 16 (iii) 64

18.



Fraction of heterozygous tall plants in $F_2 = \frac{1}{2}$.

This can be explained by law of segregation which states that the members of the allelic pair that remained together in the parent, segregate during gamete formation and only one factor enters a gamete.

19. Primary treatment phase of sewage treatment removes floating and suspended solids from sewage through two processes of filtration and sedimentation. First floating matter is removed through sequential filtration. The filtrate is kept in large open settling tanks where grit settles down. Aluminium or iron sulphate is added in certain places to flocculation and settling down of solids. The sediment is called primary sludge while the supernatant is called effluent. The primary sludge traps a lot of microbes and debris. It is subjected to composting or land fill where anaerobic digestion removes the organic matter.

20. Competent host is essential for biotechnology experiment. Since DNA is a hydrophilic molecule, it cannot pass through membranes, so the bacterial cells must be made capable to take up DNA, *i.e.*, made competent.

This can be achieved by :

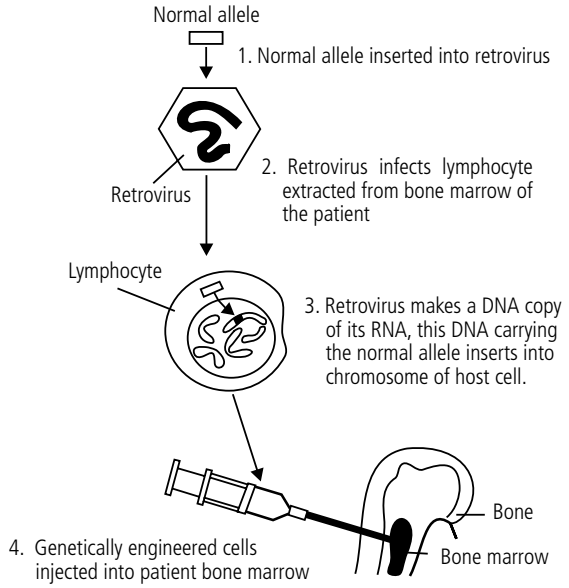
(i) Treatment of DNA with divalent cation of $CaCl_2$ or rubidium chloride. Treating them with a specific concentration of a divalent cation, increases the efficiency with which DNA enters the bacterium through pores in its cell wall.

(ii) Heat shock treatment of DNA – Recombinant DNA (rDNA) can be forced into cells by incubating the cells with recombinant DNA on ice, followed by placing them briefly at 42°C (heat shock) and then putting them back on ice. This enables the bacteria to take up the recombinant DNA.

21. Gene therapy is the technique of genetic engineering to replace a faulty gene by a normal healthy functional gene. The first clinical gene therapy was given in 1990 to a 4 years old girl with adenosine deaminase deficiency (ADA deficiency). This enzyme

is very important for the immune system to function. Severe combined immunodeficiency (SCID) is caused due to defect in the gene for the enzyme adenosine deaminase. SCID patient lacks functional T-lymphocytes and, therefore, fails to fight the infecting pathogens. Lymphocytes are extracted from the patient's bone marrow and a normal functional copy of human gene coding for ADA is introduced into these lymphocytes with the help of retroviral vector. The cells so treated are reintroduced into the patient's bone marrow. The lymphocytes produced by these cells contain functional ADA gene which reactivate the victim's immune system.

Though these cells are not immortal, the patient requires periodic infusion of such genetically engineered lymphocytes. However, if the gene isolated from marrow cells producing ADA is introduced into cells at early embryonic stages, it could be a permanent cure. Steps of gene therapy can be summarised in the given diagram.



22. (i) Selection by resistance to antibiotics : The desired gene or DNA is placed in either of the marker genes, *e.g.*, amp^R gene in pBR322. The transformed cells or colonies are replica plated on ampicillin containing medium. The recombinant clones will be sensitive to ampicillin (due to inactivation of amp^R gene). Such recombinants can be selectively identified from master plate.

(ii) Blue white screening : Alternative selectable markers have been developed which differentiate recombinants from non-recombinants on the basis of their ability to produce colour in the presence of chromogenic substrate. When the foreign DNA is inserted within the coding sequence of enzyme β-galactosidase, it results in inactivation of enzyme and is called insertional inactivation. The presence of a chromogenic substrate gives blue coloured colonies, if the plasmid in the bacteria does not have an insert. Presence of an insert results in insertional inactivation of the β-galactosidase and the colonies do not produce any colour, which are identified as recombinant colonies.

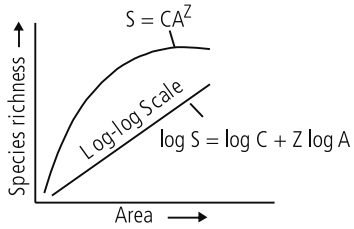
(iii) Colony hybridisation : It is the most efficient and rapid method of identifying the recombinant cells. In this method, the recombinant DNA is denatured and incubated with specific radioactive DNA or RNA probes to allow annealing. The DNA with probes are identified by autoradiography.

OR

Agrobacterium tumefaciens is a soil-inhabiting bacterium that may invade growing plants at the junction of root and stem, where it can cause a cancerous growth known as a crown gall. *A. tumefaciens* contains Ti plasmid which carries gene for tumour formation. for using *Agrobacterium tumefaciens* as a cloning vector researchers deleted the genes which governs auxin and cytokinin production (the oncogene) from T-DNA of Ti plasmid. It is known as disarming. After disarming, this T-DNA is inserted into chromosomes of the host plant where it produces copies of itself.

23. Species area relationship of biodiversity was given by Alexander Von Humboldt while he was exploring the South American jungles. He observed that within a region species richness increased with increasing explored area, but only up to a limit. The relation between species richness and area for a wide variety of taxa turns out be a rectangular hyperbola.

The graph of species area relationship is as follows:



On a logarithmic scale, the relationship is a straight line described by the equation,

$\log S = \log C + Z \log A$

where

S = Species richness

A = Area

Z = Slope of the line (regression coefficient)

C = Y-intercept

The value of Z lies in the range of 0.1 to 0.2, regardless of the taxonomic group or the region. But, if the species area relationships among very large areas like the entire continents is analysed, the slope of the line is much steeper (Z values in the range of 0.6 to 1.2).

24. Exceptions to the universality of genetic code are:
(i) UAA and UGA are termination codons and do not code for any amino acid. But in *Paramecium* and some other ciliates, these codons code for glutamine.
(ii) Genetic code is non-overlapping in most organisms. But, $\phi \times 174$ has 5375 nucleotides that code for 10 proteins which require more than 6000 bases. Three of its genes E, B and K overlap other genes. Nucleotide sequence at the beginning of E gene is contained within gene D. Likewise gene K overlaps with genes A and C. A similar condition is found in SV-40.
More than one codons code for a single amino acid, thus are called degenerate codons. In degenerate codes, the first two nitrogen bases are similar while the third one is different, *e.g.*, UUU and UUC are the degenerate codes that code for amino acid phenylalanine.

25. In brood parasitism, the parasitic bird lays its eggs in the nest of its host and the host incubates them. During the course of evolution, the eggs of the parasitic bird evolve to resemble the host's egg in size and colour to reduce the chances of the host's bird detecting the foreign eggs and ejecting them from the nest.

26. Two principle procedures adopted for test tube baby programme are ZIFT (Zygote Intra Fallopian Transfer) and IUT (Intra Uterine Transfer). In this procedure fusion of ovum and sperm is done outside the body of a woman, in the laboratory to form a zygote. The zygote is then allowed to divide forming 8 blastomeres and is transferred into the Fallopian tube (ZIFT - Zygote Intra Fallopian Transfer). If the embryo is with more than 8 blastomeres it is transferred into the uterus (IUT - Intra Uterine Transfer) to complete its further development. Thus , this is *in vitro* fertilisation (IVF - fertilisation outside the body in almost similar conditions as that in the body) followed by embryo transfer (ET).

27. Haemophilia is genetically due to the presence of a recessive sex linked gene 'h', carried by X chromosome. It is generally observed in males as a single gene for the defect is able to express itself as the Y chromosome is devoid of any corresponding allele (X^hY). Women will suffer from this disorder only when both X chromosomes carry gene 'h' (X^hX^h). *E.g.*, when a carrier woman (XX^h) marries with haemophilic man (X^hY), 50% girl babies will be carriers (XX^h) while the remaining 50% will be haemophilic (X^hX^h).

28. Tall plants may either have genotype TT or Tt. Two tall pea plants that produce some dwarf plants among their progenies must be heterozygous with the genotype Tt, because TT plants cannot produce dwarf offspring as they lack the allele for dwarfness (t) and hence cannot transfer it to the progeny. Besides, both of them should have a 't' allele as dwarfness is expressed in homozygous (tt) condition only. It can be expressed using Punnett square as follows:

Tt × Tt

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

29. (a) *Bacillus thuringiensis* produces Bt toxin, an insecticidal protein. This protein kills insects such as lepidopterans (tobacco budworm, armyworm), coleopterans (beetles) and dipterans (flies, mosquitoes), but it does not kill the *Bacillus* (bacterium) itself.
(b) *cry* gene codes for this toxin. The toxin does not kill the bacterium *Bacillus*, as it exists in the form of inactive protoxins. However, once an insect ingests the inactive toxin, it is converted into an active form of toxin, due to the alkaline pH of the gut, which then creates pores in the midgut epithelial cells and cause cell swelling, lysis and finally death of the insect.
(c) Proteins encoded by genes *cry* IAc and *cry* IIAb control the cotton bollworms, while *cry* IIAb controls corn borers.

OR

(i) *Escherichia coli*
(ii) Origin of replication (*ori*) is a sequence from where replication starts and is also responsible for controlling the copy number of the inserted gene.
(iii) The given vector contains amp^R as selectable marker. It helps in selecting transformants (host cells containing vector) and eliminating non-transformants. Host cells containing amp^R are resistant to antibiotic ampicillin.

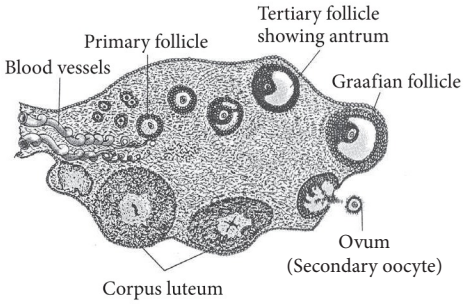
30. (a) Colostrum (mother's first milk) rich in IgA antibodies provides natural passive immunity to new born. In passive immunity, ready-made antibodies are directly injected into a person to protect the body against foreign agents.

Through vaccination artificial active immunity will be provided to the newborn in which his own cells will produce antibodies in response to vaccine. *E.g.*, BCG vaccine for tuberculosis.

(b) (i) IgA

(ii) IgE

31. (a) Diagrammatic sectional view of human ovary showing the development of follicles, corpus luteum and ovulation is as follows:

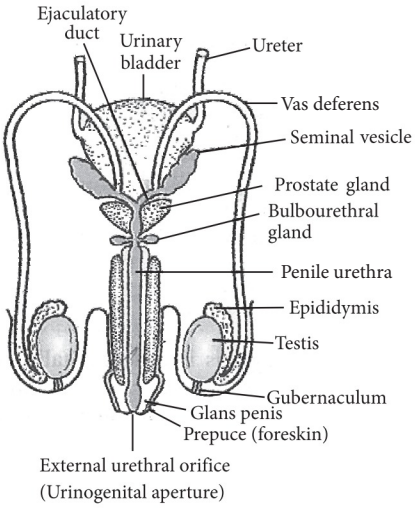


(b) GnRH secreted by the hypothalamus stimulates the anterior lobe of pituitary gland to secrete LH and FSH. FSH stimulates the growth of Graafian follicles and also the development of egg/oocyte within the follicle to complete the meiosis I to form secondary oocyte. FSH also stimulates the formation of estrogens. LH induces the rupture of the mature Graafian follicle and thereby the release of secondary oocyte. Thus LH causes ovulation. The remaining part of the Graafian follicle is stimulated by LH to develop into corpus luteum which secretes progesterone.

The rising level of progesterone inhibits the release of GnRH, which in turn, inhibits production of FSH, LH and progesterone.

OR

(a) Diagrammatic view of human male reproductive system is as follows:



(b) (i) Differences between vasa efferentia and vasa deferentia are as follows:

S. No.	Vasa efferentia	Vasa deferentia
(i)	They arise from the rete testis.	They arise from the cauda epididymis.
(ii)	They vary from 15 to 20 in number.	They are only 2 in number.
(iii)	Vasa efferentia are fine.	Vasa deferentia are thick.
(iv)	Their lining bears many ciliated cells.	Their lining has many stereocilia.
(v)	They carry spermatozoa from the rete testis to the epididymis.	They carry spermatozoa from cauda epididymis to the ejaculatory duct.

(ii) Differences between spermatogenesis and spermiogenesis are as follows:

S. No.	Spermatogenesis	Spermiogenesis
(i)	It is the process of formation of haploid spermatozoa from germinal cells.	It is the process of differentiation of spermatozoon from a spermatid.
(ii)	It involves conversion of a diploid structure into haploid structures.	It changes a haploid structure into another haploid structure.
(iii)	There is growth and division during spermatogenesis.	There is reconstruction during spermiogenesis. Divisions and growth are absent.
(iv)	No organelle is lost.	Golgi bodies are lost during spermiogenesis.
(v)	A spermatogonium forms four spermatozoa.	Here a spermatid forms a single spermatozoon.
(vi)	It consists of multiplication phase, spermatocytogenesis, maturation phase and differentiation phase.	It consists of only differentiation phase.

32. (i) The given figure depicts inversion, a type of chromosomal aberration. Due to inversion, part of chromosome segment gets inverted by 180°.

(ii) Inversion involving centromere is called pericentric whereas inversion occurring beyond a centromere is termed as paracentric. Hence, it is a type of pericentric inversion assuming 'c' as the point of centromere.
(iii) Inversion inhibits the chromosomal synapsis in the region of change. Crossing over results in the formation of duplications, deficiencies, breaking of chromosome homologues into dicentric and acentric portions (paracentric inversion) resulting in sterility (50%), persistence of inversions (25%) and normal gametes (25%).

OR

(i) The given cross shows Morgans' experiment on *Drosophila*.
'A' is red eyed carrier female, 'B' is red eyed male, 'C' is Y-chromosome and 'D' is X-chromosome carrying eye colour gene.
(ii) Here, the eye colour gene is linked to sex chromosome and is present of X-chromosome showing criss-cross inheritance.
(iii) In criss-cross inheritance, the trait is transferred from parent to grand child of same sex through offspring of the opposite sex. A father transmits his traits to his grandson through daughter while a mother transmits the traits to her granddaughter through her son.

33. Life cycle of *Plasmodium* requires two hosts for completion, such a two host life cycle is called digenetic.
I. Life cycle of *Plasmodium* in man - Asexual phase
(i) Infective stage of *Plasmodium* is sporozoite. When the mosquito bites another human, sporozoites are injected with bite.
(ii) Parasites (sporozoites) reach the liver through blood.
(iii) The parasite reproduces asexually in liver cells, bursting the cells and releasing into the blood.
(iv) Parasites enter the red blood cells (RBCs) and reproduce asexually there bursting the red blood cells and causing cycles of fever and other symptoms. Released parasites infect new red blood cells.
(v) Sexual stages develop in RBCs.
II. Life cycle of *Plasmodium* in female anopheles mosquito - Sexual phase
(i) Female mosquito takes up gametocytes with blood meal.
(ii) Fertilisation and development take place in the mosquito's stomach.
(iii) The zygote elongates and becomes motile called ookinete.
(iv) The ookinete moves and bores through the wall of the stomach of female *Anopheles* mosquito. The ookinete changes to oocyst on the surface of the stomach.
(v) Inside the oocyst, sporozoites are formed which are released in the body cavity of the mosquito.
(vi) Mature infective stages (sporozoites) move to different organs of the body cavity but many of them penetrate salivary glands of mosquito.
(vii) When the female *Anopheles* mosquito bites a healthy person, the sporozoites are injected in his/her blood alongwith saliva.

OR

Cancer is the uncontrolled growth of abnormal cells anywhere in the body. These abnormal cells are cancer cells, that can infiltrate normal body tissues. The normal cells are characterised by contact inhibition by virtue of which contact with other cells inhibits their uncontrolled growth. Metastasis is a property shown by cancerous cells in which these cells detach from the tumors and move to distant sites through body fluids and develop secondary tumors. Metastasis is fatal because the cancerous cells damage other normal cells, compete with them for vital nutrients and disrupt the normal metabolism. Several genes called cellular oncogenes (c-onc) or proto oncogenes have been identified in normal cells which, when activated under certain conditions, could lead to oncogenic transformation of the cells (cancer).
Cancer of internal organs can be detected by technique like Radiography (X-rays) and CT (computerised tomography).
The cancer patients are given substances called biological response modifiers such as α-interferon which activate their immune system and helps in destroying the tumor.

☺ ☺ ☺