Sample Paper 1

Biology (044)

Class XII Session 2022-23

Time: 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. What is meant by the term Darwin fitness?

(a) Healthy appearance

(b) High aggressiveness

(c) The ability to survive and reproduce

(d) Physical straight

2. Which of the following is a plasmid?

(a) Sal I

(b) Barn HI

(c) pBR322

(d) Eco RI

3. Which of the following crosses will give tall and dwarf pea plants in same proportions?

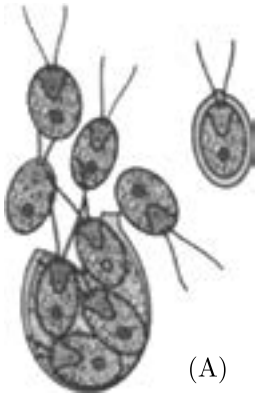
(a) TT × tt

(b) tt × tt

(c) TT × Tt

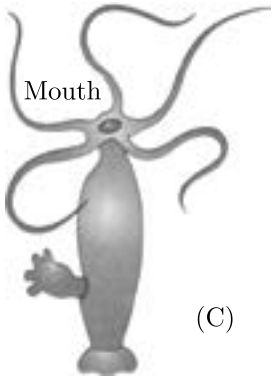
(d) Tt × tt

4. The given figures show the members of fungi and simple plants such as algae which undergo asexual reproduction. Identify the correct asexual reproductive structures found in the members A, B, C and D.

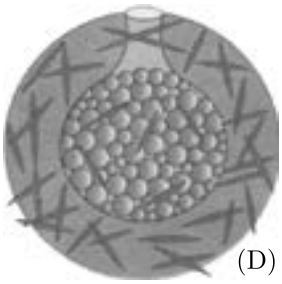


(A) Chlamydomonas

(B) Penicillium



(C) Hydra



(D) Sponge

(a) A-Zoogamete, B-Conidia, C-Bud, D-Gemmule

(b) A-Aplanospore, B-Conidia, C-Bud, D-Gemmule

(c) A-Zoospore, B-Conidiosporangium, C-Bud, D-Gemmule

(d) A-Zoospore, B-Conidia, C-Bud, D-Gemmule

5. Egg apparatus consists of

(a) egg cell and two synergids.

(b) egg cell and central cell.

(c) egg cell and antipodal cells.

(d) egg cell and one synergid.

6. The feature of some structures of male reproductive system is given below. Identify the structure on the basis of the characteristics which surrounds the primary sex organ of male reproductive system.

(a) It is responsible for maintaining the low temperature by about 2 - 2.5° C from normal body temperature to mature sperm.

(b) It travels through the penis and carry semen as well as urine.

(c) Its enlarged end is called glans penis.

(d) Stores sperms prior to ejaculation.

7. Amniocentesis technique is used for the

(a) sex determination of foetus

(b) determination of any genetic abnormality in the embryo

(c) determination of errors in amino acid metabolism in embryo.

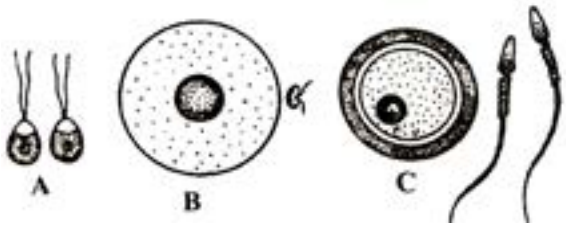
(d) Both (b) and (c)

8. The ratio of phenotypes in F2 of a monohybrid cross is

(a) 9 : 3 : 3 : 1 (b) 1 : 2 : 1

(c) 3 : 1 (d) 2 : 1

9. The given figures (A, B and C) are types of gametes of different organisms. Identify gametes (A, B and C) respectively.



(a) Heterogametes, isogametes, Homogametes

(b) Homo/Isogametes, heterogametes, heterogametes

(c) Homogametes, isogametes, heterogametes

(d) Isogametes, homogametes, heterogametes

10. Dark coloured Peppered Moth is able to survive in industrial areas as compared to light coloured form because of

(a) Natural selection in smoky environment

(b) Mimicry

(c) High fecundity

(d) Lethal mutation

11. Progestogens in the contraceptive pill

(a) checks attachment of zygote endometrium (b) inhibits estrogen

(c) prevents ovulation (d) All of the above

12. Person having genotype IA IB would show the blood group as AB. This is because of

(a) Pleiotropy (b) incomplete dominance

(c) segregation (d) Codominance

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

13. **Assertion:** Pyramid of energy maybe upright or inverted.
Reason: Only 10% of energy goes to next trophic level.

(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.

14. **Assertion :** UAA, UAG and UGA terminate protein synthesis.
Reason : They are not recognised by tRNA.

(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.

15. **Assertion :** Bt cotton is resistant to insects.
Reason : Butterfly feeding on Bt cotton will die.

(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.

16. **Assertion:** Jave Ape man, Peking man and Heidelberg man are the fossils of Homo erectus.
Reason: Homo erectus evolved from Homo habilis.

(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.

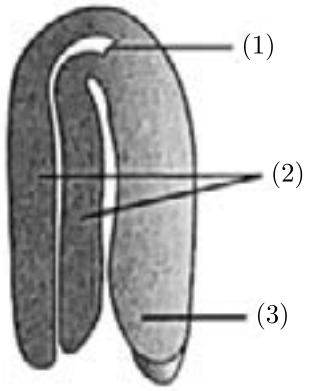
SECTION-B

17. How is genetic engineering used in molecular diagnosis of disease ?

18. What does S-shaped pattern of population growth represent ? How is J-shaped pattern different from it and why ?

19. In humans, insulin is synthesised as a pro-hormone that needs to be processed before it becomes a fully mature and functional hormone. How is this challenge for production of insulin using rDNA techniques overcome for getting insulin assembled into a mature form? Explain the steps using flow chart.

20. In the adjacent figure of a typical dicot embryo, label the parts (1), (2) and (3). State the function of each of the labelled part.



21. What do you mean by gametogenesis ? Describe the structure of a human sperm.

SECTION-C

22. Gregor Mendel conducted hybridisation experiments on garden peas and proposed the laws of inheritance in living organisms. For his experiments, Mendel

(A) conducted artificial pollination experiments using several true-breeding pea lines which were similar except for one character with contrasting traits.

(B) applied statistical analysis and mathematical logic to problems in biology

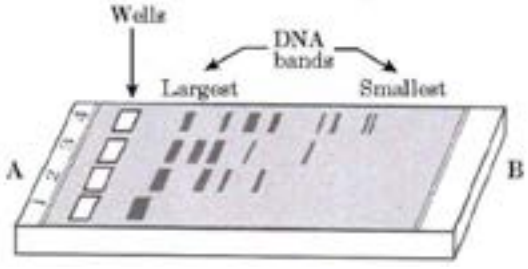
(a) What are true-breeding lines? Explain with the help of an example.

(b) Why did Mendel use true-breeding lines for his hybridisation experiments?

(c) Name one mathematical logic used by Mendel. Which other method can be used for the same?

23. A person is suffering from ringworm disease. Mention the pathogen. Give the symptoms of the disease along with the mode of transmission.

24.



Observe the diagram of gel electrophoresis and answer the questions which follow:

(a) Name the substance used as a medium/matrix in gel electrophoresis along with its source.

(b) Why does DNA move towards the anode in gel electrophoresis?

(c) How one can observe DNA in the gel after electrophoresis?

25. A decade ago, there was abundance of Abingdon tortoise in Galapagos Island but now this species has become extinct?

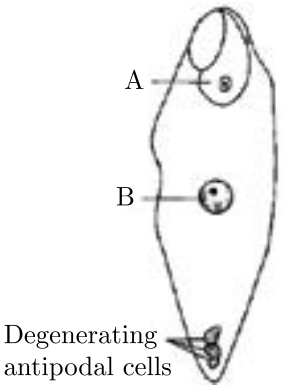
(a) Why have they become extinct?

(b) What can you say about such a relation?

or

Name and describe different hierarchial levels of biological diversity

26. The diagram below shows embryo sac after fertilisation. Observe it and answer the following questions.



(a) Give the names of the structures which develop from parts labelled as A and B in the above diagram.

(b) How is the structure developed from part '13' different from perisperm?

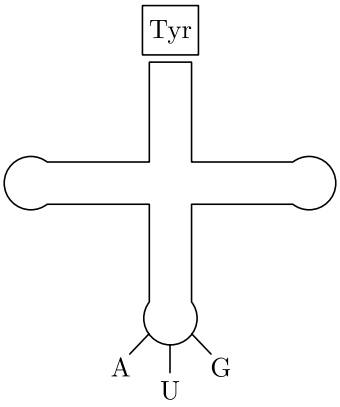
(c) Meiocyte of onion has 16 chromosomes. What will be the number of chromosomes in the structures developing from parts 'A' and `13'?

27. (a) Name any two copper releasing IUDs.

(b) Explain how do they act as effective contraceptives in human females.

28. (i) Francis Crick.

(ii)



Clovel leaf structure of tRNA

(iii) The actual structure of tRNA looks like inverted L.

SECTION-D

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

Sex Determination:

The cytological observations made in a number of insects led to the development of the concept of genetic/ chromosomal basis of sex-determination. Henking (1891) could trace a specific nuclear structure all through spermatogenesis in a few insects, and it was also observed by him that 50 per cent of the sperm received this structure after spermatogenesis, whereas the other 50 per cent sperm did not receive it. Henking gave a name to this structure as the X body but he could not explain its significance. Further investigations by other scientists led to the conclusion that the 'X body' of Henking was in fact a chromosome and that is why it was given the name X-chromosome. It was also observed that in a large number of insects the mechanism of sex determination is of the XO type, i.e., all eggs bear an additional X-chromosome besides the other chromosomes (autosomes). On the other hand, some of the sperms bear the X-chromosome whereas some do not. Eggs ertilised by sperm having an X-chromosome become females and, those fertilised by sperms that do not have an X-chromosome become males. Grasshopper is an example of X0 type of sex determination in which the males have only one X-choromosome besides the autosomes, whereas females have a pair of X-chromosomes. insects and mammals including man, XY type of sex determination is seen where both male and female have same number of chromosomes.

Among the males an X-chromosome is present but its counterpart is distinctly smaller and called the Y-chromosome. Females, however, have a pair of X-chromosomes. Both males and females bear same number of autosomes. Hence, the males have autosomes plus XY, while female have autosomes plus XX. In human beings and in Drosophila the males have one X and one Y chromosome, whereas females have a pair of X chromosomes besides autosomes. 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 are designated to be the example of male heterogamety. 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. In order to have a distinction with the mechanism of sex determination described earlier, 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.

(i) Organism that have XO type of sex-determination?
(ii) What factors determines a human child's sex?
(iii) Which type of sex chromosome found in female bird?
(iv) Name the gametes produces by males?

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

Acquired immunity and Graft Rejection:

Acquired immunity, on the other hand, is pathogen specific. It is characterised by memory. This means that our body when it encounters a pathogen for the first time produces a response called primary response which is of low intensity. Subsequent encounter with the same pathogen elicits a highly intensified secondary or anamnestic response. This is ascribed to the fact that our body appears to have memory of the first encounter. The primary and secondary immune responses are carried out with the help of two special types of lymphocytes present in our blood, i.e., B-lymphocytes and T- lymphocytes.The B-lymphocytes produce an army of proteins in response to pathogens into our blood to fight with them. These proteins are called antibodies. The T-cells themselves do not secrete antibodies but help B cells produce them. Each antibody molecule has four peptide chains, two small called light chains and two longer called heavy chains. Hence, an antibody is represented as H_2L_2. Different types of antibodies are produced in our body. IgA, IgM, IgE, IgG are some of them.

Because these antibodies are found in the blood, the response is also called as humoral immune response. This is one of the two types of our acquired immune response - antibody mediated. The second type is called cell-mediated immune response or cell-mediated immunity (CMI). The T-lymphocytes mediate CMI. Grafts from just any source - an animal, another primate, or any human beings cannot be made since the grafts would be rejected sooner or later. Tissue matching, blood group matching are essential before undertaking any graft/transplant and even after this the patient has to take immuno-suppresants all his/her life. The body is able to differentiate 'self' and 'nonself and the cell-mediated immune response is responsible for the graft rejection.

(i) What type of response mediated by antibodies?
(ii) Which cell is responsible for cell mediated immunity?
(iii) Which molecules are most responsible for rejection of transplant?
(iv) Which immunoglobulin does constitute the largest percentage in human milk?

SECTION-E

31. (a) Bacillus thuringiensis acts as a microbial biocontrol agent for protecting Brassica and fruit trees from butterfly caterpillers. Explain.

(b) (i) List the components of biogas.
(ii) How can the activated sludge be used as a source of biogas?

32. Many plant and animal species are on the verge of their extinction because of loss of forest land by indiscriminate use by the humans.

(a) Why there is a need to conserve biodiversity?
(b) Mention a method that you would suggest to protect such threatened species from getting extinct.
(c) Alien species are highly invasive and are a threat to indigenous species. Substantiate this statement with any two examples.

or

Refer the table given below and answer the following questions.
Table : Types of Interaction

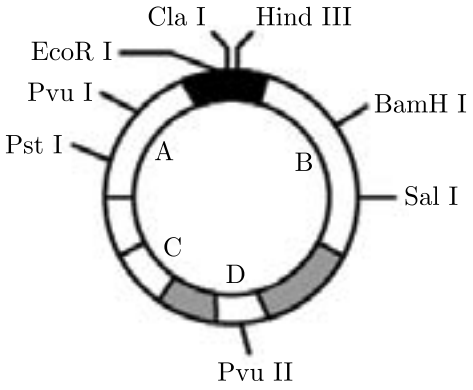
Species A	**Species B**	**Name of Interaction**
÷	+	P
—	—	Q
+	—	R
+	—	S
+	0	T
—	0	U

(a) Identify P, Q, R, S, T and U.
(b) (i) An orchid growing as an epiphyte on a mango branch is an example of which interaction?
(ii) Name the type of interaction seen between wasp and fig tree.
(c) Give one example of interaction 'P'.

33. DNA is a hydrophilic molecule so it cannot pass through cell membranes. In order to force host bacteria to take up the plasmid, the bacterial cells must first be made 'competent'. How are bacterial cells made competent? Summarise the steps that are performed to introduce alien DNA into competent bacterial cells? How can alien DNA be introduced into plant and animal host cells?

or

Given below is the schematic diagram of a cloning vector pBR322. Observe the diagram and answer the following questions.



(a) Write the term for segment C of the vector. Why is it important?

(b) Segments A and B of the vector have restriction sites for many endonucleases, each of which is represented by letters followed by Roman numeral. Explain the naming of any one restriction enzyme.

(c) A foreign DNA has been inserted in the segment B. How one can identify E. coli cells with recombinant plasmids from cells with no plasmid or with non-recombinant plasmids?

□□□□□□□

Sample Paper 1 Solutions

Biology (044)

Class XII Session 2022-23

Time: 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. What is meant by the term Darwin fitness?

(a) Healthy appearance

(b) High aggressiveness

(c) The ability to survive and reproduce

(d) Physical straight

Ans : (c) The ability to survive and reproduce

Darwin fitness is the ability to survive and reproduce. It is a type of natural selection that considers the role relatives play when evaluating the genetic fitness of a given individual. It is based on the concept of inclusive fitness, which is made up of individual survival and reproduction (direct fitness) and any impact that an individual has on the survival and reproduction of relatives (indirect fitness).

2. Which of the following is a plasmid?

(a) Sal I (b) Barn HI

(c) pBR322 (d) Eco RI

Ans : (c) pBR322

pBR 322 is an artificially constructed vector plasmid. It is widely used in gene cloning experiments.

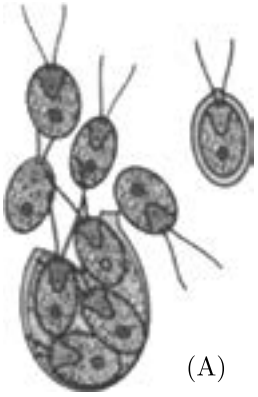
3. Which of the following crosses will give tall and dwarf pea plants in same proportions?

(a) TT × tt (b) tt × tt

(c) TT × Tt (d) Tt × tt

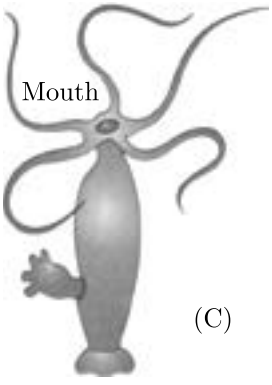
Ans : (d) Tt × tt

4. The given figures show the members of fungi and simple plants such as algae which undergo asexual reproduction. Identify the correct asexual reproductive structures found in the members A, B, C and D.

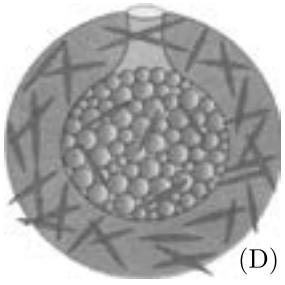


(A) Chlamydomonas

(B) Penicillium



(C) Hydra



(D) Sponge

(a) A-Zoogamete, B-Conidia, C-Bud, D-Gemmule
(b) A-Aplanospore, B-Conidia, C-Bud, D-Gemmule
(c) A-Zoospore, B-Conidiosporangium, C-Bud, D-Gemmule
(d) A-Zoospore, B-Conidia, C-Bud, D-Gemmule

Ans : (d) A-Zoospore, B-Conidia, C-Bud, D-Gemmule

In the given figure of Chlamydomonas (A), Penicillium (B), Hydra (C) and sponge (D), the asexual reproductive structure found in them are respectively zoospore, conidia, bud and gemmules.

5. Egg apparatus consists of
(a) egg cell and two synergids.
(b) egg cell and central cell.
(c) egg cell and antipodal cells.
(d) egg cell and one synergid.

Ans : (a) egg cell and two synergids.

Egg apparatus consists of two synergids and one egg cell lying at the micropylar end.

6. The feature of some structures of male reproductive system is given below. Identify the structure on the basis of the characteristics which surrounds the primary sex organ of male reproductive system.
(a) It is responsible for maintaining the low temperature by about 2 - 2.5° C from normal body temperature to mature sperm.
(b) It travels through the penis and carry semen as well as urine.
(c) Its enlarged end is called glans penis.
(d) Stores sperms prior to ejaculation.

Ans : (a) It is responsible for maintaining the low temperature by about 2 - 2.5° C from normal body temperature to mature sperm.

The scortum helps in maintaining the low temperature of the testes 2-2.5°C which is lower than of normal body temperature.

7. Amniocentesis technique is used for the
(a) sex determination of foetus
(b) determination of any genetic abnormality in the embryo
(c) determination of errors in amino acid metabolism in embryo.
(d) Both (b) and (c)

Ans : (d) Both (b) and (c)

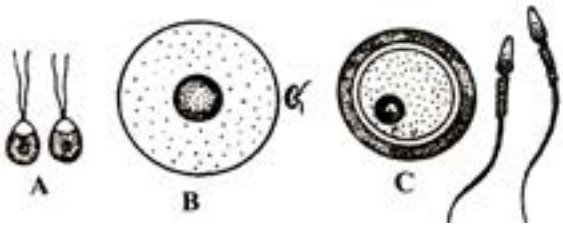
Amniocentesis is a technique used for the determination of inborn error and herediatory disorders in the developing foetus by using amniotic fluid that surrounds the developing foetus.

8. The ratio of phenotypes in F2 of a monohybrid cross is
(a) 9 : 3 : 3 : 1
(b) 1 : 2 : 1
(c) 3 : 1
(d) 2 : 1

Ans : (a) 3 : 1

Monohybrid cross is the ratio which is obtained in F2 generation when monohybrid cross is made & the offsprings of F1 generation are self bred.
Mendel crossed pure tall and dwarf plants. The plants belonged to F1 generation, all tall hybrid, were self-pollinated. The plants of F2 generation were both tall and dwarf, in approximate 3 : 1 ratio phenotypically and 1 : 2 : 1 genotypically.

9. The given figures (A, B and C) are types of gametes of different organisms. Identify gametes (A, B and C) respectively.



(a) Heterogametes, isogametes, Homogametes
(b) Homo/Isogametes, heterogametes, heterogametes
(c) Homogametes, isogametes, heterogametes
(d) Isogametes, homogametes, heterogametes

Ans : (b) Homo/Isogametes, heterogametes, heterogametes

The type of gametes shown in the figure A (Cladophora, an algae), B (Fucus, an algae) and C (Homo sapiens) are respectively homo/isogametes, heterogametes and heterogametes.

10. Dark coloured Peppered Moth is able to survive in industrial areas as compared to light coloured form because of

(a) Natural selection in smoky environment

(b) Mimicry

(c) High fecundity

(d) Lethal mutation

Ans : (a) Natural selection in smoky environment

11. Progestogens in the contraceptive pill

(a) checks attachment of zygote endometrium

(b) inhibits estrogen

(c) prevents ovulation

(d) All of the above

Ans : (c) prevents ovulation

Birth control pills (oral contraceptives) check ovulation in female by inhibiting the secretion of follicle stimulating hormone and luteinizing hormone that are important for ovulation.

12. Person having genotype IA IB would show the blood group as AB. This is because of

(a) Pleiotropy

(b) incomplete dominance

(c) segregation

(d) Codominance

Ans : (d) Codominance

The example of codominance is ABO blood grouping in humans. ABO blood groups are controlled by gene I. Gene I consists three alleles I^A, I^B and iI^A and I^B are the dominant alleles. When I^A and I^B are present together, both express equally and produce the surface antigens A and B, whereas i is the recessive allele and does not produce any antigen.

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

13. **Assertion:** Pyramid of energy maybe upright or inverted.
Reason: Only 10% of energy goes to next trophic level.

(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.

Ans : (c) A is true but R is false.

Energy flow in the ecosystem is a unidirectional. There is a decline in the amount of energy passing from one trophic level to the next. Thus the pyramid of energy is always upright. According to Lindemann, only 10% of energy goes to next trophic level.

14. **Assertion :** UAA, UAG and UGA terminate protein synthesis.
Reason : They are not recognised by tRNA.

(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.

Ans : (a) Both A and R are true and R is the correct explanation of A.

Synthesis of polypeptide terminates when a nonsense codon of mRNA reaches the A site. There are three nonsense codons—UAA, UAG and UGA. These codons are not recognised by any of the tRNAs. Therefore, no more aminoacyl tRNA reaches the A site. The P site tRNA is hydrolysed and the completed polypeptide is released in the presence of a release factor.

15. **Assertion :** Bt cotton is resistant to insects.
Reason : Butterfly feeding on Bt cotton will die.

(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.

Ans : (c) A is true but R is false.

Bt cotton is an insect-resistant transgenic crop designed to combat the bollworm.

16. **Assertion:** Jave Ape man, Peking man and Heidelberg man are the fossils of Homo erectus.
Reason: Homo erectus evolved from Homo habilis.

(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.

Ans : (a) Both A and R are true and R is the correct explanation of A.

The fossil of Java Ape man was discovered from Pleistocene rocks in central Java. The fossil of Peking man was discovered from the lime stone caves of Choukoutien near Peking while that of Heidelberg man was discovered in mid pleistocene. All these three fossils come under the category of Homo erectus. Homo erectus appeared about 1.7 million years ago in the middle pleistocene. H. erectus evolved from Homo habilis. He was about 1.5-1.8 metres tall and had erect posture. His skull was flat than that of the modern man. He had protruding jaws, projecting brow ridges, small canines and large molar teeth. He made more elaborate tools of stones and bones, hunted big animals and perhaps knew the use of fire.

SECTION-B

17. How is genetic engineering used in molecular diagnosis of disease ?

Ans :

Molecular diagnosis includes all tests and methods to identify a disease or the predisposition for a disease analyzing DNA or RNA of an organism. Genetic engineering used in molecular diagnosis of disease is shown by the following points.

(i) Recombinant DNA molecules and techniques like PCR (Polymerase chain Reaction) are used for early diagnosis of disorders.

(ii) Cloned genes when expressed to produce recombinant proteins, help in developing sensitive diagnostic techniques like ELISA.

(iii) The cloned genes are also used as "probes" to detect the pressure of complementary DNA strand. A probe is a piece of single stranded DNA, that is tagged with a radioactive molecule and it is used to find its molecule and it is used to find its complementary DNA by hybridization. It is followed by detection of radioactivity by autoradiography. Presence of normal or mutant gene can be detected using such a method.

(iv) PCR is used to detect HIV and to detect mutations in gene.

18. What does S-shaped pattern of population growth represent ? How is J-shaped pattern different from it and why ?

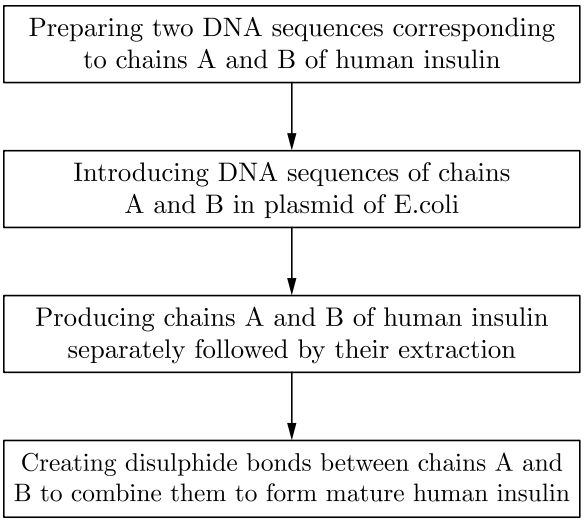
Ans :

Environmental resistance exerting an effect upon the biotic potential, resulting in an S-shaped population growth curve, stabilising at the carrying capacity of the environment.
The S-shaped curve describes a situation in which, in the new environment, the population density of an organism increases initially very slowly. When it adapts to new conditions and establish on itself, it increases rapidily, approaching an exponential growth. On the other hand, the J- shaped curve describes a situation in which after the lag phase is over, the population growth continues in an exponential form until stopped suddenly, as the environmental resistance suddenly came into existence and becomes effective.

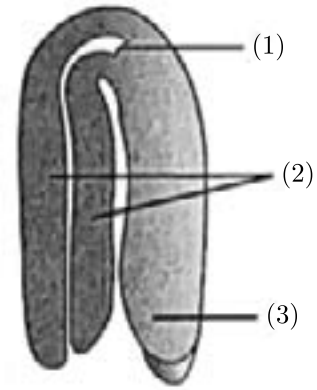
19. In humans, insulin is synthesised as a pro-hormone that needs to be processed before it becomes a fully mature and functional hormone. How is this challenge for production of insulin using rDNA techniques overcome for getting insulin assembled into a mature form? Explain the steps using flow chart.

Ans :

Each mature insulin molecule consists of two chains —A and B linked together by disulphide bridges. Insulin, in humans, is synthesised as a prohomione which contains an extra stretch called C-peptide.
The steps to produce mature insulin without C-peptide using recombinant DNA technology are:



20. In the adjacent figure of a typical dicot embryo, label the parts (1), (2) and (3). State the function of each of the labelled part.



Ans :

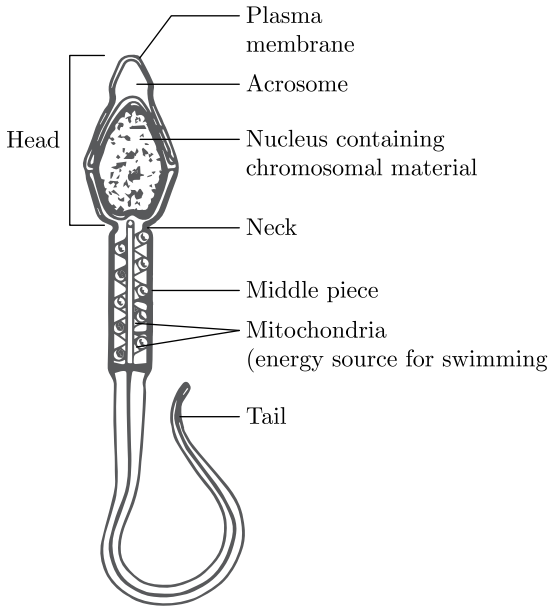
	Name of Part	**Function**
1.	Plumule	Gives rise to stem.
2.	Cotyledons	Provide nourishment to the embryo.
3.	Radicle	Gives rise to root.

21. What do you mean by gametogenesis ? Describe the structure of a human sperm.

Ans :

Gametogenesis carried out in gonads, is the formation of gametes for sexual reproduction. It is controlled by gonadotrophic hormones (FSH, LH, ICSH etc) secreted by pituitary gland. Meiosis is the most significant part of the of gametogenesis. The male reproductive organ or testis undergo spermatogenesis and the female reproductive organ or ovary, oogenesis. As a result of reduction division or meiosis, the sperms and the ova produced have only half the number of chromosomes as compared to body cells of the parent.

Human sperm is microscopic in structure. It is composed of head, neck, middle piece and tail. The whole sperm is covered by a plasma membrane. The head portion has an elongated nucleus whose anterior portion is covered by a cap like acrosome. The acrosome is derived from the Golgi complex & contains hydrolysing enzymes for the sperm penetration. The nucleus contain haploid set of chromosomes. The middle piece has several mitochondria which provide energy for sperm movement. The tail helps in motility of sperm.



SECTION-C

22. Gregor Mendel conducted hybridisation experiments on garden peas and proposed the laws of inheritance in living organisms. For his experiments, Mendel

(A) conducted artificial pollination experiments using several true-breeding pea lines which were similar except for one character with contrasting traits.

(B) applied statistical analysis and mathematical logic to problems in biology

(a) What are true-breeding lines? Explain with the help of an example.

(b) Why did Mendel use true-breeding lines for his hybridisation experiments?

(c) Name one mathematical logic used by Mendel. Which other method can be used for the same?

Ans :

(a) A true-breeding line is an organism that breeds true for a particular character, i.e., they produce offspring that are identical to their parents for this character on selfing or crossing within the population. For example, a true-breeding pea plant with white flowers, on selfing, will produce progeny plants with white flowers only.

(b) True-breeding lines are produced through continuous self pollination and are thus, homozygous for the alleles for the trait of interest. Mendel used true-breeding lines because these lines show the stable trait inheritance and expression for several generations.

(c) Mendel used probability to calculate the possible outcomes of a cross. Punnett square is one such method that can be used to calculate the same.

23. A person is suffering from ringworm disease. Mention the pathogen. Give the symptoms of the disease along with the mode of transmission.

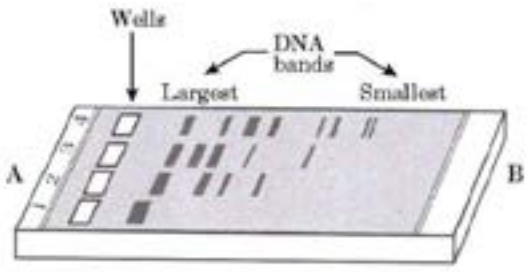
Ans :

(a) Pathogen: Ringworm is caused by fungi belonging to genera Microsporum, Trichophyton and Epider-mophyton.

(b) Symptoms: Dry, scaly lesions on different body parts like skin, scalp and nails, accompanied by intense itching, etc.

(c) Transmission: It is acquired from soil or transmitted by contact with articles such as towels, comb or clothes used by an infected person.

24.



Observe the diagram of gel electrophoresis and answer the questions which follow:

(a) Name the substance used as a medium/matrix in gel electrophoresis along with its source.

(b) Why does DNA move towards the anode in gel electrophoresis?

(c) How one can observe DNA in the gel after electrophoresis?

Ans :

(a) Agarose is used as matrix to separate DNA in gel electrophoresis. It is extracted from sea weeds.

(b) The DNA fragments are negatively charged so they move towards the positively charged anode under an electric field through matrix.

(c) The separated DNA fragments in the gel can be visualised only after staining the gel with a compound known as ethidium bromide followed by exposure to UV radiation. After staining and exposing the gel to UV light, DNA appears as bright orange coloured bands in the gel.

25. A decade ago, there was abundance of Abingdon tortoise in Galapagos Island but now this species has become extinct?

(a) Why have they become extinct?

(b) What can you say about such a relation?

or

Name and describe different hierarchial levels of biological diversity

Ans :

(a) Earlier there were only Abingdon tortoise in Galapagoes Island lent when goats were introduced into the island, they faced stiff competition from goats. Goats were found to be better browsers than tortoise, and so their numbers started declining.

(b) Competition among individuals causes fight for the resources and those who are strong or have better abilities survive while others with lesser or weaker abilities perish. It shows survival of the fittest.

or

Ans :

Biodiversity includes three interrelated hierarchial levels:

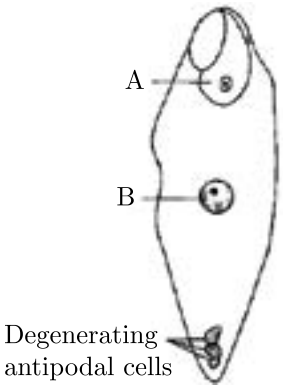
(i) Genetic diversity: The genetic variation found in a single species over its distributional range is

called genetic diversity. The greater the genetic diversity of a species, higher is its efficiency to adapt. Greater the diversity, wider is the geographical distribution.

(ii) Species diversity: The variety in number and richness of the species of a region is known as species diversity.

(iii) Ecosystem diversity The different variety of ecosystems within a geographical area is called ecosystem diversity.

26. The diagram below shows embryo sac after fertilisation. Observe it and answer the following questions.



(a) Give the names of the structures which develop from parts labelled as A and B in the above diagram.

(b) How is the structure developed from part '13' different from perisperm?

(c) Meiocyte of onion has 16 chromosomes. What will be the number of chromosomes in the structures developing from parts 'A' and `13'?

Ans :

(a) Part A represents zygote which develops into the embryo. Part B represents primary endosperm nucleus from which endosperm develops.

(b) Perisperm is the diploid nutritive tissue, which develops from the persistent nucellus whereas endosperm, the structure that develops from part 'B' or primary endosperm nucleus, is the triploid nutritive tissue, which develops from fusion of secondary nucleus with one of the male gametes.

(c) Meiocyte is a diploid structure.
Number of chromosomes in meiocyte (2n) of onion =16
Number of chromosomes in zygote or part A (2n) =16
Number of chromosomes in endosperm or part B (3n) = 24

27. (a) Name any two copper releasing IUDs.

(b) Explain how do they act as effective contraceptives in human females.

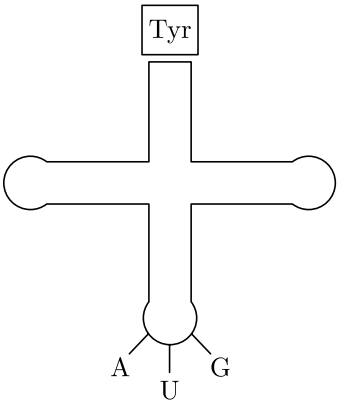
Ans :

(a) Cu-T and Cu7 are copper releasing IUDs.

(b) IUDs work as contraceptive in following ways :
(i) Increases phangocytosis of sperms.
(ii) Making uterus less suitable for implantation.
(iii) making cervix hostile to sperms.
(iv) Suppressing sperm motility and fertilising ability by releasing copper ions.

28. (i) Francis Crick.

(ii)



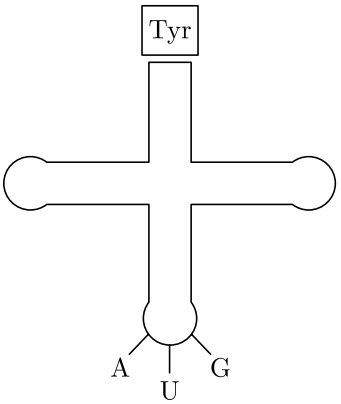
Clovel leaf structure of tRNA

(iii) The actual structure of tRNA looks like inverted L.

Ans :

(i) Francis Crick.

(ii)



Clovel leaf structure of tRNA

(iii) The actual structure of tRNA looks like inverted L.

SECTION-D

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

Sex Determination:

The cytological observations made in a number of insects led to the development of the concept of genetic/chromosomal basis of sex-determination. Henking (1891) could trace a specific nuclear structure all through spermatogenesis in a few insects, and it was also observed by him that 50 per cent of the sperm received this structure after spermatogenesis, whereas the other 50 per cent sperm did not receive it. Henking gave a name to this structure as the X body but he could not explain its significance. Further investigations by other scientists led to the conclusion that the 'X body' of Henking was in fact a chromosome and that is why it was given the name X-chromosome. It was also observed that in a large number of insects the mechanism of sex determination is of the XO type, i.e., all eggs bear an additional X-chromosome besides the other chromosomes (autosomes). On the other hand, some of the sperms bear the X-chromosome whereas some do not. Eggs ertilised by sperm having an X-chromosome become females and, those fertilised by sperms that do not have an X-chromosome become males. Grasshopper is an example of X0 type of sex determination in which the males have only one X-choromosome besides the autosomes, whereas females have a pair of X-chromosomes. insects and mammals including man, XY type of sex determination is seen where both male and female have same number of chromosomes.

Among the males an X-chromosome is present but its counterpart is distinctly smaller and called the Y-chromosome. Females, however, have a pair of X-chromosomes. Both males and females bear same number of autosomes. Hence, the males have autosomes plus XY, while female have autosomes plus XX. In human beings and in Drosophila the males have one X and one Y chromosome, whereas females have a pair of X chromosomes besides autosomes. 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 are designated to be the example of male heterogamety. 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. In order to have a distinction with the mechanism of sex determination described earlier, 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.

(i) Organism that have XO type of sex-determination?
(ii) What factors determines a human child's sex?
(iii) Which type of sex chromosome found in female bird?
(iv) Name the gametes produces by males?

Ans :

(i) Grasshopper
(ii) Sex of a human child in determined by sex chromosome of father.
(iii) Female bind has been designated to be the Z and W chromosomes.
(iv) Males produce two different types of gametes:
  (a) X-chromosome (with or without)
  (b) X-chromosome and Y-chromosome

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

Acquired immunity and Graft Rejection:

Acquired immunity, on the other hand, is pathogen specific. It is characterised by memory. This means that our body when it encounters a pathogen for the first time produces a response called primary response which is of low intensity. Subsequent encounter with the same pathogen elicits a highly intensified secondary or anamnestic response. This is ascribed to the fact that our body appears to have memory of the first encounter. The primary and secondary immune responses are carried out with the help of two special types of lymphocytes present in our blood, i.e., B-lymphocytes and T- lymphocytes. The B-lymphocytes produce an army of proteins in response to pathogens into our blood to fight with them. These proteins are called antibodies. The T-cells themselves do not secrete antibodies but help B cells produce them. Each antibody molecule has four peptide chains, two small called light chains and two longer called heavy chains. Hence,

an antibody is represented as H_2L_2. Different types of antibodies are produced in our body. IgA, IgM, IgE, IgG are some of them. Because these antibodies are found in the blood, the response is also called as humoral immune response. This is one of the two types of our acquired immune response - antibody mediated. The second type is called cell-mediated immune response or cell-mediated immunity (CMI). The T-lymphocytes mediate CMI. Grafts from just any source - an animal, another primate, or any human beings cannot be made since the grafts would be rejected sooner or later. Tissue matching, blood group matching are essential before undertaking any graft/transplant and even after this the patient has to take immuno-suppresants all his/her life. The body is able to differentiate 'self' and 'nonself and the cell-mediated immune response is responsible for the graft rejection.

(i) What type of response mediated by antibodies?
(ii) Which cell is responsible for cell mediated immunity?
(iii) Which molecules are most responsible for rejection of transplant?
(iv) Which immunoglobulin does constitute the largest percentage in human milk?

Ans :

(i) Humoral immune response
(ii) Cytotoxic-T cell
(iii) T-lymphocytes (cells)
(iv) IgA

SECTION-E

31. (a) Bacillus thuringiensis acts as a microbial biocontrol agent for protecting Brassica and fruit trees from butterfly caterpillers. Explain.

(b) (i) List the components of biogas.
(ii) How can the activated sludge be used as a source of biogas?

Ans :

(i) Nucleotides of DNA contain deoxyribose sugar and nitrogen bases other than uracil while in RNA, the nucleotides contain ribose sugar and nitrogen bases except thymine.
(ii) RNA is a reactive molecule which functions as messenger, adapter, structural and in some cases as catalytic molecule.
(iii) DNA is a most suitable genetic material because:
(a) less reactive and structurally more stable.
(b) capable of replication.
(c) have the property to mutate, a requirement for evolution.
(d) able to express in the form of Mendelian characters.
(iv) Values: Teacher try to explains and articulate a concept in a simple language so that students understand it clearly.

or

Ans :

(a) Bacterium Bacillus thuringiensis (Bt) are available in sachets as dried spores which when mixed with water and sprayed onto vulnerable plants, such as Bras-sica and fruit trees, are eaten up by the insect larvae. The toxins are released in the gut once eaten, and larva gets killed.
(b) (i) Methane, H_2S, CO_2, H_2
(ii) A major part of the activated sludge is pumped into large tanks called anaerobic sludge digesters. In these digesters, methanogens grow anaerobically on cellulosic material and digest the bacteria and the fungi in the sludge. During digestion, methanogens produce large amount of methane along with CO_2 and H_2. These gases form biogas.

32. Many plant and animal species are on the verge of their extinction because of loss of forest land by indiscriminate use by the humans.

(a) Why there is a need to conserve biodiversity?
(b) Mention a method that you would suggest to protect such threatened species from getting extinct.
(c) Alien species are highly invasive and are a threat to indigenous species. Substantiate this statement with any two examples.

or

Refer the table given below and answer the following questions.

Table : Types of Interaction

Species A	Species B	Name of Interaction
÷	+	P
—	—	Q
+	—	R

+	—	S
+	0	T
—	0	U

(a) Identify P, Q, R, S, T and U.
(b) (i) An orchid growing as an epiphyte on a mango branch is an example of which interaction?
(ii) Name the type of interaction seen between wasp and fig tree.
(c) Give one example of interaction 'P'.

Ans :

(a) There is a need to conserve biodiversity due to the following three reasons:
(i) Narrowly utilitarian: To continuously get the products for human consumption.
(ii) Broadly utilitarian: Plays a major role in many ecosystem services that nature provides and that is invaluable.
(iii) Ethical: Moral duty to pass on biological legacy in good order to future generation.

(b) I would suggest the following method to protect the threatened species from becoming extinct:
(i) Ex situ conservation: The threatened species of plants and animals are taken out of their habitats and are kept in special setting such as zoological parks, botanical gardens and wildlife safari parks. In the present scenario, the gametes of endangered species can be preserved by methods like cryopreservation and can be fertilised in vitro followed by propagation through tissue culture methods. Similarly, seeds can be preserved in seed banks. This type of conservation method is an off-site conservation method.

(c) Examples to support the statement that alien species are invasive and threat to indigenous species are:
(i) The Nile perch introduced into Lake Victoria in east Africa led eventually to the extinction of an ecologically unique assemblage of more than 200 species of cichlid fish in the lake. Since, cichlid fish became extinct and so the Nile perch, not finding any food for itself, died too.
(ii) The environmental damage caused a threat to our native species by invasive weed species like carrot grass (Parthenium), Lantana and water hyacinth (Eichhornia).
(iii) The recent illegal introduction of the African cat-fish, Clarias gariepinus for aquaculture purposes is posing a threat to the indigenous catfishes in our rivers.

or

Ans :

(a) P — Mutualism Q — Competition
R — Predation S — Parasitism
T — Commensalism U —Amensalism

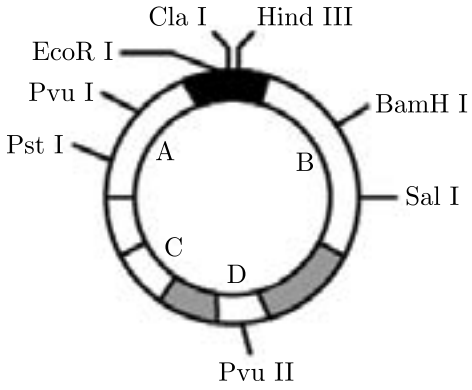
(b) (i) Commensalism (Q).
(ii) Mutualism

(c) Nitrogen — fixing bacteria (Rhizobium) living in root nodules of legumes represent mutualism (P).

33. DNA is a hydrophilic molecule so it cannot pass through cell membranes. In order to force host bacteria to take up the plasmid, the bacterial cells must first be made 'competent'. How are bacterial cells made competent? Summarise the steps that are performed to introduce alien DNA into competent bacterial cells? How can alien DNA be introduced into plant and animal host cells?

or

Given below is the schematic diagram of a cloning vector pBR322. Observe the diagram and answer the following questions.



(a) Write the term for segment C of the vector. Why is it important?
(b) Segments A and B of the vector have restriction sites for many endonucleases, each of which is represented by letters followed by Roman numeral. Explain the naming of any one restriction enzyme.
(c) A foreign DNA has been inserted in the segment B. How one can identify E. coli cells with recombinant plasmids from cells with no plasmid or with non-recombinant plasmids?

Ans :

(i) Bacterial host cells are made competent by treating them with a specific concentration of a divalent cation, such as calcium. As a result, pores are created in the bacterial cell wall through which DNA can enter the cell.

(ii) The steps required to introduce alien DNA into competent bacterial cells are:
(iii) Incubation of competent bacterial cells with recombinant DNA on ice.
(iv) Placing the mixture briefly at 42 °C (heat shock), and then putting them back on ice.
(v) The alien DNA can be introduced into:
(vi) Plant cells by a method known as biolistics or gene gun in which cells are bombarded with high velocity micro-particles of gold or tungsten coated with DNA.
(vii) Animals cells by a method known as micro-injection in which recombinant DNA is directly injected into the nucleus of an animal cell.

or

Ans :

(a) Segment C is ori (origin of replication). This is a sequence from where replication starts. So, any piece of DNA when linked to this sequence can be made to replicate within the host cells. It is also responsible for controlling the copy number of the linked DNA.
(b) In the name of any restriction enzyme, for example EcoR I, the first letter represents the genus' i.e., 'E' represents the genus Escherichia and the second two letters represent the species of the prokaryotic cell from which they were isolated, i.e., 'co' comes from coli. In EcoR I, the letter 'R' is derived from the name of strain. Roman numbers following the names indicate the order in which the enzymes were isolated from that strain of bacteria.
(c) Segment B is tetracycline resistance gene. If a foreign DNA is inserted in this gene, the recombinant plasmids will lose tetracycline resistance. E. coli cells transformed with recombinant plasmids can be selected out from non-recombinant ones by growing the cells on ampicillin containing medium then transferring them on a medium containing tetracycline. The recombinants will grow in ampicillin containing medium but not on that containing tetracycline. But, non- recombinants will grow on the medium containing both the antibiotics.

□□□□□□□