Sample Paper 10

Biology (044)

Class XII Session 2022-23

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

General Instructions:

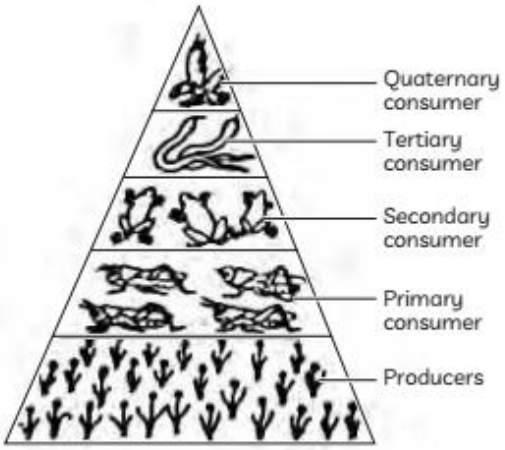
1. All questions are compulsory.
2. The question paper has five sections and 33 questions. All questions are compulsory.
3. Section—A has 16 questions of 1 mark each; Section—B has 5 questions of 2 marks each; Section—C has 7 questions of 3 marks each: Section—D has 2 case-based questions of 4 marks 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

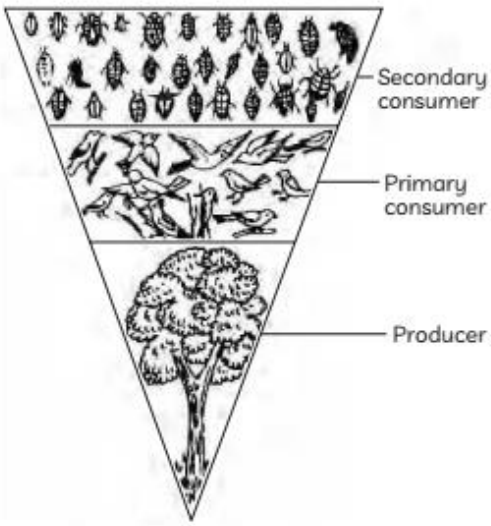
16 Marks

1. **Identify the correct pyramid of number in grassland ecosystem.**

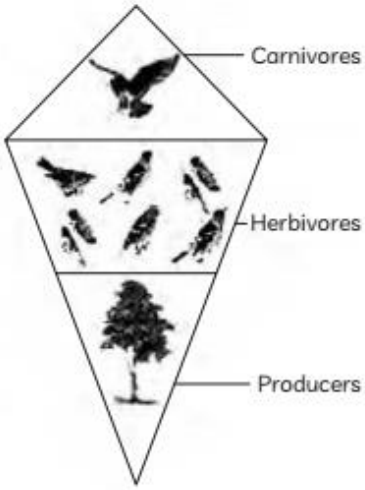
(a)



(b)



(c)



(d) None of these 1

2. **Which gland is at its largest in children, but with the onset of puberty, it eventually shrinks and gets replaced by fat?**

(A) Thymus (B) Hypothalamus

(C) Parathyroid (D) Pituitary 1

3. **Match the following enzymes with their functions:**

Column-I		Column-II	
(A)	Restriction endonuclease	(i)	Joins the DNA fragments
(B)	Restriction exonuclease	(ii)	Extends primers on genomic template

(C)	DNA ligase	(iii)	Cuts DNA at specific position
(D)	Tag polymerase	(iv)	Removes nucleotides from the ends of DNA

Select the correct option from the following:

(a) (A)-(ii), (B)-(iv), (C)-(i), (D)-(iii)

(b) (A)-(iii), (B)-(i), (C)-(iv), (D)-(ii)

(c) (A)-(iii), (B)-(iv), (C)-(i), (D)-(ii)

(d) (A)-(iv), (B)-(iii), (C)-(i), (D)-(ii) 1

4. Which one of the following is not the importance of cryopreservation in conservation of biodiversity?

(a) Preservation of gametes of threatened species.

(b) To create seed bank.

(c) To produce offsprings of different genetic strains.

(d) To preserve the threatened plants only. 1

5. In Gause's competitive exclusion principle competitively ..... one will be eliminated eventually.

(a) inferior

(b) superior

(c) cannot be determined

(d) none of the above 1

6. The technique of Amniocentesis helps us to study the pattern of chromosomes in foetal cells and detection of any chromosomal disorders. But still this crucial technique is banned in India because:

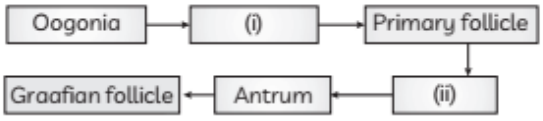
(a) it was high in demand

(b) it leads to killing of girl child

(c) of lack of technology

(d) it doesn't detect the sex of the foetus 1

7. Fill in the missing boxes for the levels in the transformation of mother germ cells into a mature follicle.



	(i)	(ii)
(a)	Secondary ooctye	Primary follicle
(b)	Secondary follicle	Primary ooctye
(c)	Primary ooctye	Secondary follicle
(d)	Ovum	Tertiary follicle

1

8. In a pond, there were 800 frogs. 60 more were born in a year. Calculate the birth rate of the population.

(a) 0.865 (b) 0.075

(c) 0.086 (d) 1 1

9. Identify the advantage of lactational amenorrhea as a contraceptive method.

(a) Only useful for beastfeeding woman

(b) No HIV protection

(c) No side effects

(d) None of the above 1

10. Which scientist showed the relation between species richness and explored area?

(a) Messelson and Stahl

(b) Alexander von Humboldt

(c) Linus Pauling

(d) Watson and Crick 1

11. ....(i).... is adjustment of an organism to its ..(ii).. fitting it better for the existence.

	(i)	(ii)
(a)	Analogous	environment
(b)	Genetic drift	home
(c)	Gene pool	country
(d)	Adaptation	environment

1

12. Identiy the incorrect example of natural selection:

(a) Industrial melanism

(b) Sickle cell anemia

(c) Darwin's finches

(d) Resistance of mosquitoes to DDT 1

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

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

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

13. Assertion (A): Signals for parturition originate from placenta and the developed foetus.

Reason (R): Relaxin is released by the placenta. 1

14. The preserved remains, or traces of remains, of extinct organisms are called fossils. An entire organism or just a portion of one can be preserved as a fossil. Leaves, feathers, shells, bones, and shells can all turn into fossils.

Assertion (A): The fossil record offers direct evidence for common descent.

Reason (R): You can trace the ancestory of a particular group. 1

15. Assertion (A): Recombinant DNA can not easily pass through cell membranes.

Reason (R): DNA is a hydrophobic molecule. 1

16. Assertion (A): Restriction endonuclease play an important role in recombinant DNA technology.

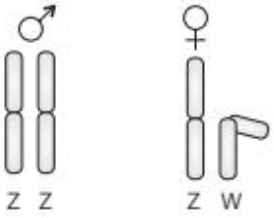
Reason (R): Linking of antibiotic resistance gene with plasmid vector became possible with DNA ligase. 1

SECTION - B

10 Marks

17. Write any two advantages of using apomictic seeds of hybrid varieties. 2

18. Explain in brief how sex is determined in birds with the following sex chromosomes.



2

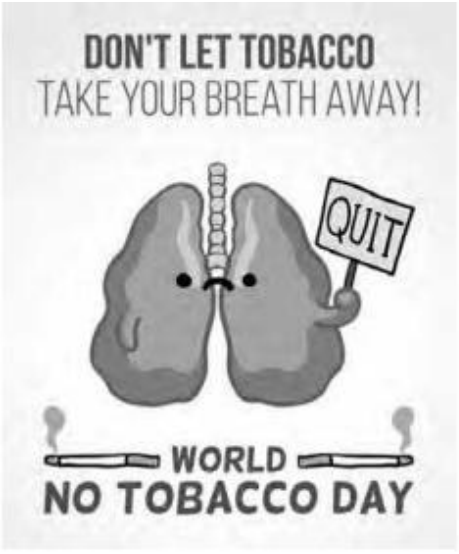
19. Sheela gave birth to a child. But when doctor told her that her child is suffering from Down's syndrome. She started crying. Write the cause and effect of the Down's syndrome. Also, mention the name of the biologist who first described it. 2

20. Fill in the table given below:

Disease	Causal organism	Vector
Malaria	A	B
C	*Flavivirus*	D

OR

World No Tobacco Day is observed around the world every year on 31 May.



Why is tobacco harmful for the health? Write any four points. 2

21. A spermatogonial cell possesses 30 chromosomes. Then write the number of chromosomes exists in:

(A) A spermatid derived from its cell

(B) Primary spermatocyte

(C) Secondary spermatocyte

(D) Spermatozoa 2

SECTION - C

21 Marks

22. Draw a labelled diagram of sectional view of a mature embryo sac of an angiosperm. 3

23. Help these patients in approximate determination of the disease they might have based on the facts they have listed below:

(A) Karimchand says that in his body, there is a mutation in the gene that codes for enzyme phenylalanine hydrolase

(B) Shriya's daughter has an extra copy of chromosome 21.

(C) Rahul has the karyotype XXY.

Mention any one symptom for each of the above diseases/disorders. 3

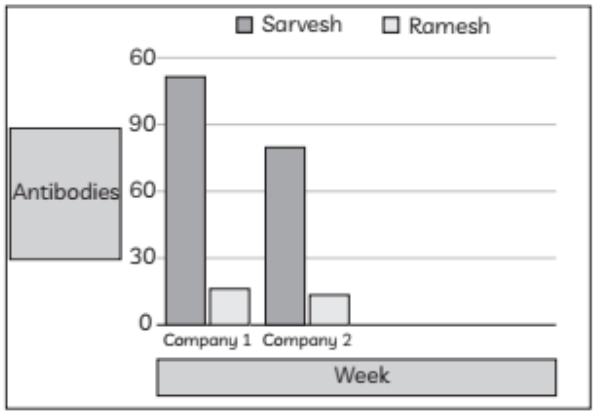
24. Explain the secondary treatment of sewage for biogas generation. 3

25. Multiple copies of a specific gene of interest are required to study the detailed sequencing of bases in it. Which process can help in developing large number of copies of this gene of interest? Explain in detail.

OR

Give reason: One of the major contributions of biotechnology is to develop pest-resistant varieties of cotton plants. Also, explain how it has been achieved. 3

26. The following graph shows the amount of antibodies in two individuals.



Observe the graph and tell:

(A) Who might be suffering from the infection by a foreign pathogen?

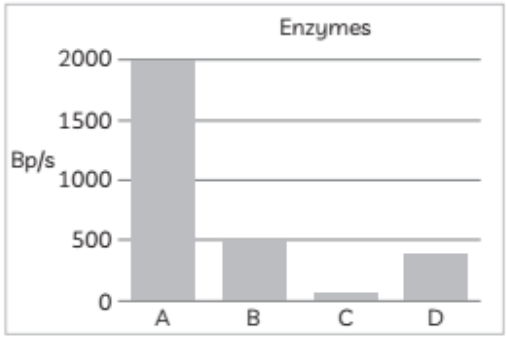
(B) Which cells mediate the cell-mediated immunity?

(C) Explain primary response to pathogens. 3

27. (A) When one goes for a trek/trip to any of the high altitude places, one is advised to take it easy and rest for the first two days. Give reasons.

(B) Describe any two barriers pertaining to the innate immunity of human body. 3

28.



3

3

Observe the graph given above and tell:

(A) Which of these enzymes could be DNA dependent DNA polymerase (E.coli)?

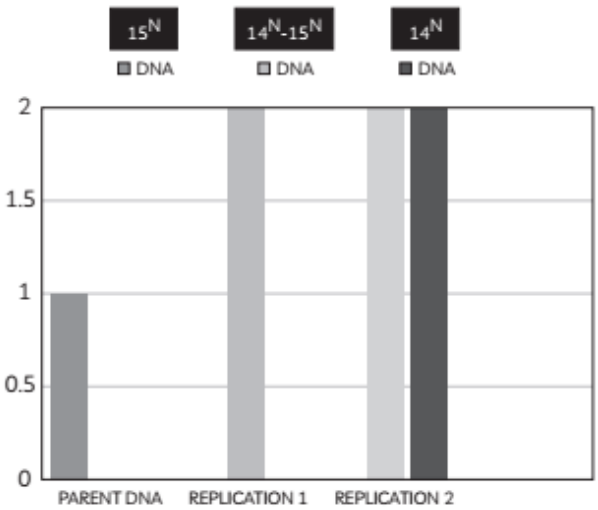
(B) Describe the process of DNA replication. 3

SECTION - D

8 Marks

(Q. No. 29 and 30 are case based questions. Each question has subparts with internal choice in one subpart.)

29. *Messelson and Stahl conducted experiments using radioactive Nitrogen to determine whether the concept of semiconservative replication of DNA is correct. They used caesium chloride ($CsCl_2$) gradient centrifugation technique for this purpose. They created DNA molecules of different densities by using normal nitrogen (^{14}N) and its heavy isotope (^{15}N). For this purpose, E. coli, a bacterium was grown, in the (^{15}N) rich culture till nitrogen in the bacterial DNA was only (^{15}N). The bacteria were later transferred to a culture medium containing only normal nitrogen that is (^{14}N). The change in density was observed by periodic sample taking exercise.*



(A) How many hybrid DNA molecules could be seen after the second replication? 1

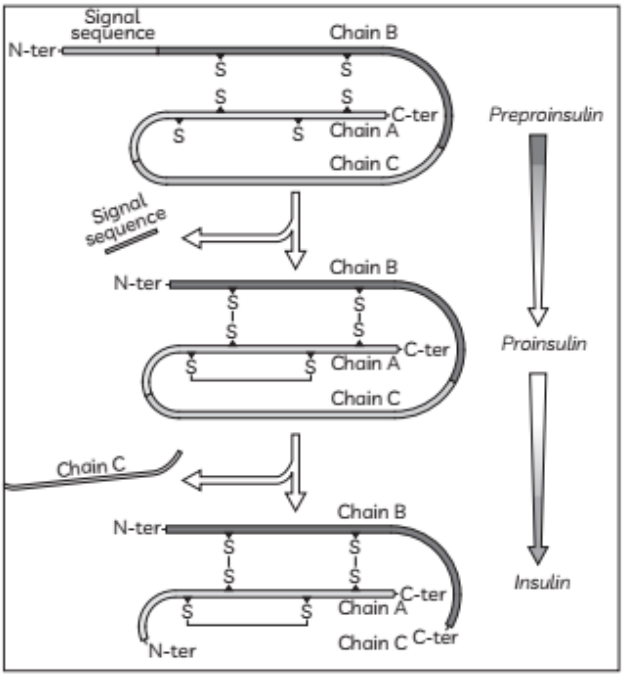
(B) Messelson and Stahl provided confirmation to whose model of DNA? 1

(C) The density of which DNA molecules increased after second round of replication?

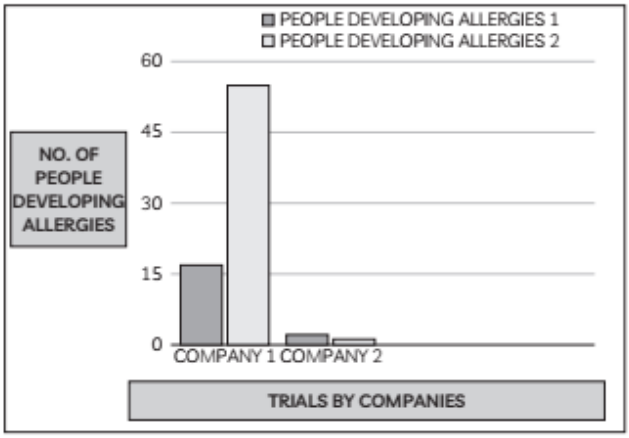
OR

What is the change in the density of the DNA in the first round of replication? 2

30. *Insulin, synthesised from an animal source needed to be processed before reaching a mature stage to be utilised by human subjects. The creation of Insulin by biotechnological interventions proved to be a boon for the diabetic patients.*



(A) Study the graph below and answer the question:



Two companies conducted Genetically Engineered Insulin trials on a group of people. By observing the graph, identify the company which might have used pro-insulin/animal sourced insulin in their trials. Explain the reason also. 1

(B) The two short polypeptide chains are linked together by what kind of bridges? 1

(C) Explain the structure of mature insulin.

OR

Describe the insulin production using recombinant DNA techniques through figure. 2

SECTION - E

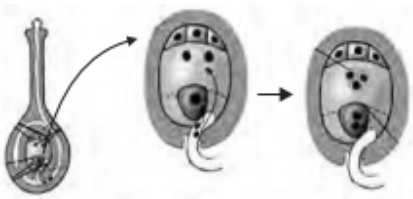
15 Marks

31. (A) Shivam was explaining the process of formation of embryo sac to one of his students. He got caught up while explaining the subsequent divisions of the functional megaspore. Help him in explaining the process.

(B) Explain why is embryo sac of an angiosperm 8 nucleate, but 7-celled.

OR

Shipra was studying for her NEET exams. She saw the following figure:



But she was unable to understand the events that happen during the double fertilisation. Help her understand the process. 5

32. (A) State the law of segregation proposed by Mendel in a monohybrid cross.

(B) What was Mendelian F_2 phenotypic ratio in a dihybrid cross? Which law was proposed by Mendel based on this ratio?

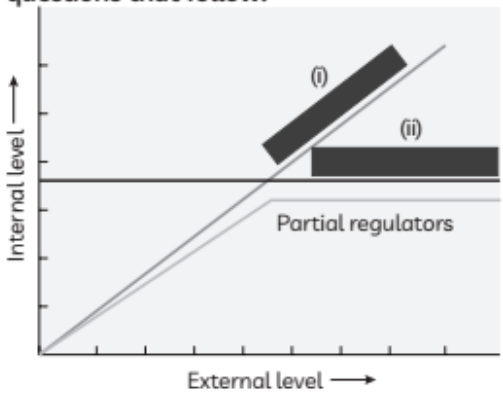
(C) How is the above law different from the law of segregation?

OR

(A) Describe the experiment which demonstrated the existence of "transforming principle".

(B) How was the biochemical nature of this "transforming principle" determined by Avery, McLeod and McCarty? 5

33. **Study the graph given and answer the questions that follow:**

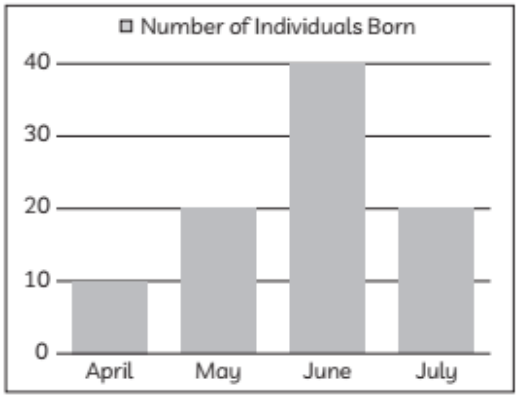


(A) Which among these can fit in the (i) or (ii) categories?
Lizards, Insects, Fishes, Mammals, Birds.
Explain the reason for your choice.

(B) Explain the strategy of suspension as a response to unfavourable conditions in the environment.

OR

Study the graph given below and answer the following questions:



(A) Calculate the birth rate for April if the number of individuals born last year was 1000.

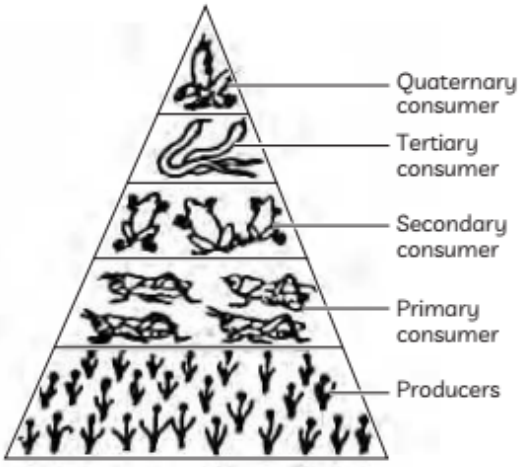
(B) What could be the probable reasons for decline in the increase and decline of individuals in the month of June and July?

(C) Define mortality and emigration. 5

SOLUTION

SECTION - A

1. *(a)*



Explanation: In a grassland ecosystem, the number of producers mostly grasses is always at its highest, followed by dwindling populations of herbivores at the second and third trophic levels and apex predators at the lowest. As a result, a grassland pyramid of numbers is vertical.

2. *(a) Thymus*

Explanation: The thymus is unique in that, in contrast to most organs, it grows the fastest in young children. The thymus gradually shrinks and is replaced by fat after you reach puberty. The thymus is essentially just fatty tissue by the age of 75. Fortunately, by the time you reach adolescence, the thymus has produced all of your T cells.

3. *(c) (A)-(iii), (B)-(iv), (C)-(i), (D)-(ii)*

Explanation: Restriction endonuclease cleaves DNA in to fragments at or near specific recognition sites within the molecule known as restriction sites.

Restriction exonucleases cleave off nucleotides one at a time from the 3' or 5' ends of DNA and RNA chains.

DNA ligase facilitates the joining of DNA strands together by catalysing the formation of a phosphodiester bond.

Taq polymerase is a thermostable DNA polymerase I named after the thermophilic bacterium, *Thermus aquaticus, from which it was originally isoloted.* It attaches nucleotides to a DNA template, thereby copying the DNA.

4. *(d) To preserve the threatened plants only*

Explanation: Gametes of threatened species can be preserved for a long time using cryopreservation. The fertility of them remains intact in most of the cases.

5. *(a) inferior*

Explanation: It states that two closely related species competing for same resources cannot co-exist indefinitely and the competitively inferior one will be eliminated eventually.

Related Theory

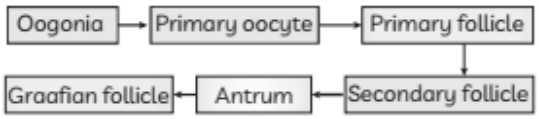
- *There could be strategies like resource partitioning, e.g. having different foraging times, which/that can help in the co-existence for closely related species pursuing same resources.*

6. *(b) it leads to killing of girl child*

Explanation: Amniocentesis was often misused in India for foetal sex determination and subsequent killing of the girl child. Hence it was banned.

7. *(c) (i): Primary oocyte; (ii) : Secondary follicle*

Explanation:



Related Theory

- *Oogenesis starts during the embryonic development stage when a couple of million gamete mother cells (oogonia) are formed within each foetal ovary. Oogonia aren't formed/or added after birth. These cells start division and enter into prophase-I of the meiotic division and get temporarily arrested at that stage, called primary oocytes.*

8. *(b) 0.075*

Explanation:

$$\text{Birth rate} = \frac{\text{number of births}}{\text{totol population}}$$

$$= \frac{60}{800}$$

= 0.075 offsprings per frog per year.

Related Theory

- *Crude birth rate can be calculated by multiplying the birth rate with 1000. Here, it will be,*

$$0.075 \times 1000 = 75.$$

9. *(c) No side effects*

Explanation: Lactational amenorrhea is a natural contraceptive method with no side effects.

Related Theory

- *Ovulation and the menstrual cycle do not occur during the period of intense lactation following parturition.*
- *Though this method is effective only upto a maximum period of six months following parturition, it has a high failure rate.*

10. *(b) Alexander von Humboldt*

Explanation: He stated that within an area, species richness increased with increasing area.

11. *(d) (i): Adaptation; (ii): environment*

Explanation: According to evolutionary theory, adaption refers to the biological process through which organisms alter or adapt to their present environment.

12. *(c) Darwin's finches*

Explanation: Darwin's finches are the best examples of adaptive radiation and not of natural selection, while rest are the examples showing the phenomenon of natural selection.

13. *(b) Both A and R are true and R is not the correct explanation of A.*

Explanation: When the foetus is fully developed, it, along with placenta, induces uterine contractions. These contractions trigger the release of hormone oxytocin from the pituitary gland of the mother. This hormone further induces stronger contractions to expel the baby through the birth canal. Relaxin is secreted by placenta as well as ovary in the later stages of pregnancy.

14. *(a) Both A and R are true and R is the correct explanation of A.*

Explanation: The fossil record offers direct evidence for common descent because you can trace the ancestory of a particular group and also sometimes can find common ancestors.

15. *(c) A is true but R is false.*

Explanation: Since DNA is a hydrophilic molecule, it cannot pass through the cell membrane. In order to make bacteria to take up the plasmid, the bacterial cells must be made competent to take up the DNA.

16. *(b) Both A and R are true and R is not the correct explanation of A.*

Explanation: The linking of antibiotic resistance gene with the plasmid vector became possible

with the enzyme DNA ligase, which acts on cut DNA molecules and joins their ends. This makes a recombinant DNA.

Restriction endonuclease cut the DNA at specific sites. They do not play any role in the joining of cut fragments.

Related Theory

➥ *Restriction enzymes cut the strand of DNA a little away from the centre of the palindrome sites, between the same two bases on the opposite strands leaving single stranded portions at the ends. These overhanging stretches on each strand are called sticky ends. These ends facilitates the joining action of the enzyme DNA ligase.*

SECTION - B

17. Farmers will have the following advantages for using apomictic seeds:

(1) The hybrid progeny will not have any change of characters.

(2) Apomictic seeds reduces cost of hybrid plant production.

Related Theory

➥ *Apomixis is a special mechanism to produce seeds without fertilisation.*

18. Birds exhibit female heterogamety (two different types of gametes). Females have one Z sex chromosome and one W sex chromosome (ZW) whereas males have a pair of Z sex chromosomes (ZZ). When sperm carrying Z chromosome fertilises Z ovum, a male offspring is produced, and when sperm carrying Z chromosome fertilizes W ovum, a female offspring is produced.

19. **Down's syndrome:**

Cause: It is caused due to the presence of an extra copy of the chromosome number 21 (Trisomy).

Effects: Short stature, small and rounded head, furrowed tongue, partially open mouth, broad palm with characteristic crease. It also causes retardation of physical, psychomotor, mental development.

It was first described by Langdon Down.

20. (A) *Plasmodium falciparum*

(B) Female Anopheles mosquito

(C) Dengue

(D) *Aedes aegypti* mosquito.

OR

Tobacco has the following harmful effects on the body:

(1) Chewing tobacco can cause mouth cancer.

(2) Tobacco has nicotine which increases blood pressure.

(3) Smoking tobacco increases carbon monoxide concentration in body. This can lead to oxygen deficiency.

(4) Tobacco smoking has harmful effects on lungs and throat.

21. (A) 15 chromosomes

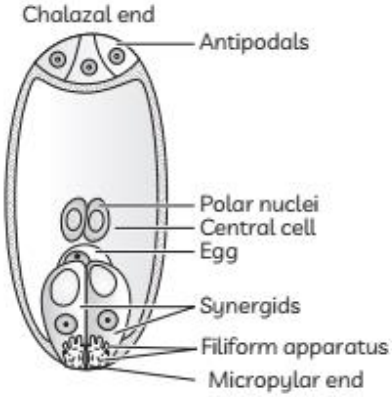
(B) 30 chromosomes

(C) 15 chromosomes

(D) 15 chromosomes

SECTION - C

22.



Embryo sac

Related Theory

➥ *In an embryo sac, 3 cells are grouped together at the micropylar end and constitute the egg apparatus. The egg apparatus has 2 synergids and one egg cell. 3 cells are at the chalazal end and are called the antipodals. The large central cell, as mentioned earlier, has two polar nuclei. Thus, a typical angiosperm embryo sac, at maturity, though 8-nucleate is 7-celled.*

23.

	Disease/ Disorder	Symptom
(A)	Phenylke-tonuria	Mental retardation
(B)	Down's syn-drome	Short stature with small round head/partially open mouth with fur-rowed tongue/broad palm with characteris-tic palm crease.
(C)	Klinefelter's syndrome	Overall masculine development with feminine features/ gynaecomastia/poor beard growth and often sterile.

24. **Secondary treatment:** Effluent is transferred through vigorous growth of aerobic microbes to the aeration tanks. The continuous aeration is done that help in aerobic breakdown of organic matter. The aerobic microbes form flocs which are the masses of bacteria associated with fungal filaments to form mesh. Then sedimentation is done to remove the soil. This reduces the BOD. Once the BOD of the sewage is reduced, it is passed into settling tank where the bacterial flocs are allowed to sediment. This sediment is known as activated sludge. Then the small part of activated sludge is pump back into aeration tank to serve as inoculum. The remaining major part of the sludge is pumped into large tanks called anaerobic sludge digesters. During this process, different gases are produced such as hydrogen sulphide, carbon dioxide, methane and then the waste can be discharged into rivers, streams *etc.*

25. Polymerase chain reaction (PCR) can help in producing large number of copies of gene of interest.

PCR is carried out in three steps:

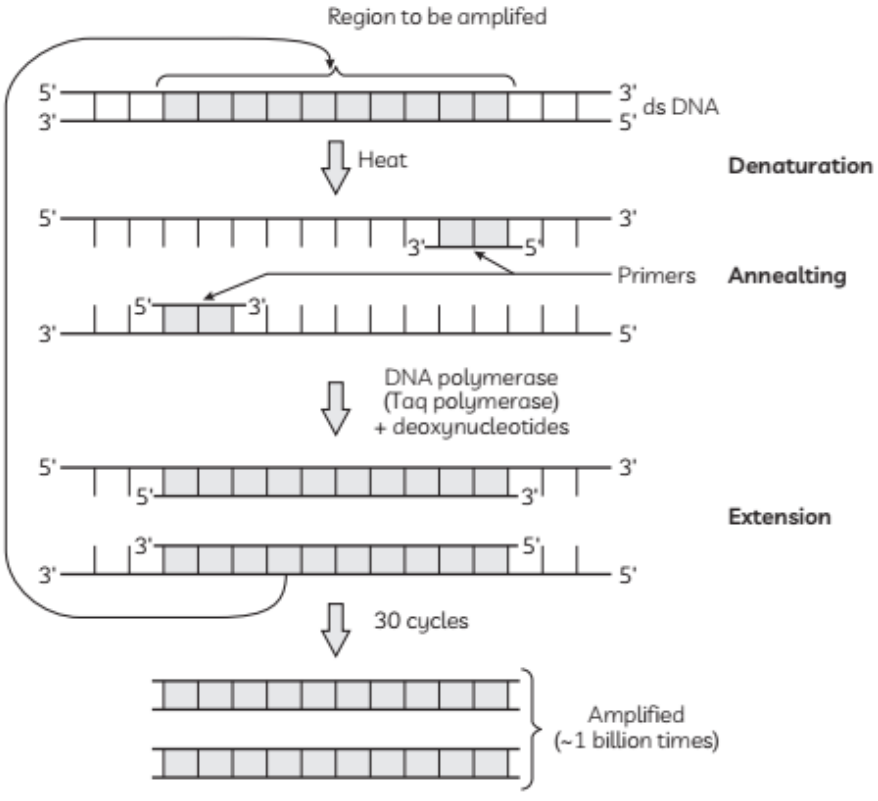
(1) **Denaturation:** The double stranded DNA possessing the gene of interest is subjected to a high temperature resulting in separation of the two strands. These strands will be acting as templates for DNA replication.

(2) **Annealing:** Two sets of primers are now added to the mixture. These primers will bind to the 3' end of each template strand. Primers are required by DNA polymerase enzyme for binding to template DNA.

(3) **Extension:** In the last step a thermostable DNA polymerase, Taq polymerase, is added to the mixture along with dinucleotides. This polymerase will add the nucleotides complementary to each of the strand and will make copies of the desired DNA in exponential manner.

After 30 cycles, around 1 billion copies of target sequence are produced from a single starting molecule.

Related Theory



Polymerase Chain Reaction

OR

Development of pest-resistant varieties of cotton plants has resulted in mass production of cotton and hence, availability of cotton clothes made easier for people at cheaper rates. It is because, Bt cotton plants aren't destroyed by the pests.

It has been made possible by introducing *cry* gene from the bacterium *Bacillus thuringiensis* into cotton plant using recombinant DNA (r-DNA) technology. *Cry* gene produces insecticidal protein in inactive state (protoxin). This protoxin after ingestion by the insect gets converted into its active form in the alkaline pH of the gut, this makes these toxin crystals soluble. The activated toxin binds to the surface of the midgut epithelial cells of the insect, thus creating pores which causes cell swelling and lysis, leading to their deaths.

Related Theory

➥ *rDNA technology stands for recombinant DNA technology. It is a process by which genome of organisms is altered for commercial purposes. The steps involved in this technology are:*

1. *Isolation of DNA having gene of interest*
2. *Using restriction endonucleases to fragment the isolated DNA*
3. *Isolating the DNA fragment having gene of interest*
4. *Amplification of gene of interest by polymerase chain reaction*
5. *Ligating the isolated DNA fragment into a vector for transfer*
6. *Transfer of recombinant DNA into host*
7. *Culturing of host cells for production*
8. *Extraction of product and downstream processing.*

26. (A) Sarvesh might be suffering from an infection by a pathogen as the number of antibodies in his body is quite high.

(B) T-lymphocytes mediate the CMI.

(C) When our body encounters a pathogen for the first time, it produces a response called primary response which is of low intensity.

Related Theory

➥ *The primary and secondary immune responses are carried out by B-lymphocytes and T-lymphocytes. The B-lymphocytes produce proteins in response to pathogens in our blood to fight them. These proteins are called antibodies. The T-cells themselves do not secrete antibodies but help B cells to produce them.*

27. (A) At high altitudes, it is advised to take rest initially because:

(1) Due to low oxygen availability, one may feel altitude sickness.

(2) Body needs to compensate for low oxygen availability during rest by increasing RBC production.

Related Theory

➥ *The process by which the body adjusts to change in external conditions is called acclimatisation. Indian army troops undergo acclimatisation before moving to high altitude battlefields.*

(B) The two types of barriers in innate immunity are:

(1) Physical barriers: Skin on our body is the main barrier which prevents entry of the micro-organisms. Mucus coating of the epithelium lining the respiratory, gastrointestinal and urogenital tracts help in trapping microbes entering our body.

(2) Physiological barriers: e.g. Acid in the stomach, saliva in the mouth for prevention of microbial growth.

28. (A) A is the DNA dependent DNA polymerase.

(B) DNA replication basically involves the following steps:

(1) **Initiation of DNA replication:** Starts at a definite site called the Origin Of Replication (Ori). Eukaryotes have several Ori.

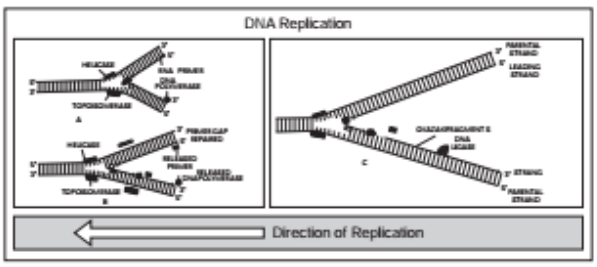
(2) **Unwinding of Helix:** Unwinding of the double helix is done by an enzyme called helicase resulting in Y-shaped replication fork. These exposed strands are stabilised by SSB (Single strand binding protein). The supercoiling developed at the opposite end is released by Topoisomerase.

(3) **Formation of Primer strand:** DNA polymerase III is the true replicase but is unable to deposit the first first nucleotide in the daughter strand (Initiation). Primase does the job by synthesising the short primer strand.

(4) **Elongation of new strand:** Synthesis of daughter strand occurs continuously across the upper strand but the lower strand is synthesised in pieces which are later joined by DNA Ligase.

Related Theory

➥



SECTION - D

29. (A) After the second round of replication, there were 4 DNA molecules of which two were hybrid and the rest two were made up of light strands (^{14}N).

(B) Watson, Crick and Franklin model of DNA.

(C) After growing them in the (^{15}N) rich culture, the DNA molecules were transferred to the medium containing only the (^{14}N) isotope and were allowed to grow for several generations. DNA made after the switch would have to be made up of (^{14}N) as this would have been the only nitrogen available for DNA synthesis. Also, the semi-conservative mode of replication underlines the present of two hybrid and 2 light (^{14}N) bands in the second generation.

OR

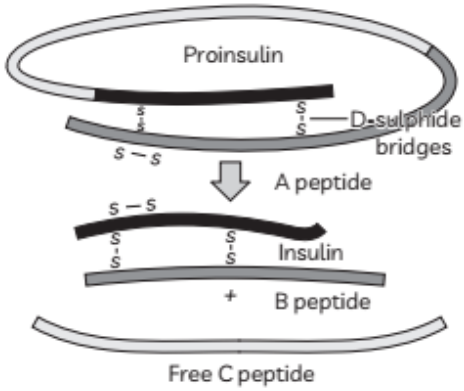
The density is halved as DNA replicates semi-conservatively, each heavy/dense DNA strand (^{15}N) will separate, acquiring a light/less dense partner (^{14}N) after one round of replication. This will be a hybrid DNA made of two strands (^{14}N – ^{15}N).

30. (A) Company 1.

The animal-sourced or pro-insulin can cause severe allergies in patients on direct administration without processing.

(B) Insulin consists of two short polypeptide chains: chain A and chain B, that are linked together by disulphide bridges.

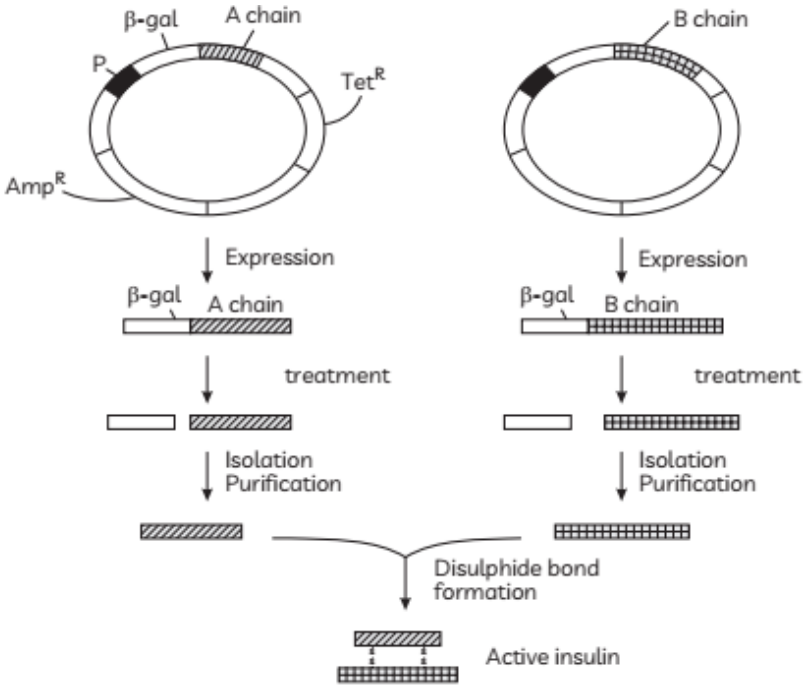
Related Theory



(C) Insulin is biologically synthesised as a pro-hormone and needs to be processed before becoming fully mature and functional. The pro-insulin contains an extra stretch called the C-peptide. This C-peptide is not present in the mature insulin and is removed during maturation into insulin.

OR

Insulin production by genetic engineering:



SECTION - E

31. (A) (1) The nucleus of the functional megaspore divides mitotically to form two nuclei which move to the opposite poles, forming the 2-nucleate embryo sac.

(2) Two more mitotic nuclear divisions result in the formation of the 4-nucleate and later the 8-nucleate stages of the embryo sac. These mitotic divisions are strictly free nuclear, not followed immediately by cell wall formation.

(3) After the 8-nucleate stage, cell walls are laid down leading to the organisation of the typical female gametophyte or embryo sac.

(4) Six of the eight nuclei are surrounded by cell walls and organised into cells; the remaining two nuclei, called polar nuclei are present below the egg apparatus in the large central cell.

(B) (1) 3 cells are grouped together at the micropylar end and constitute the egg apparatus.

(2) The egg apparatus, in turn, consists of 2 synergids and 1 egg cell.

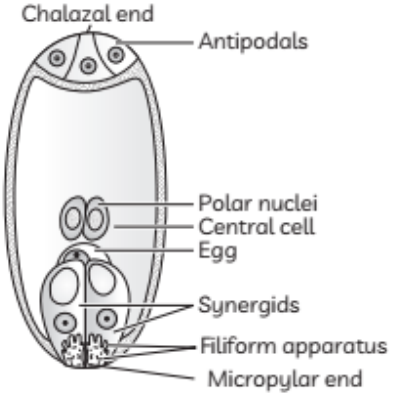
(3) 3 cells are at the chalazal end are called the antipodals.

(4) The large central cell, has two polar nuclei.

(5) Thus, a typical angiosperm embryo sac, though 8-nucleate, is 7-celled.

Related Theory

- *In flowering plants, only one out of four megaspores produced is functional.*
- *The synergids have special cellular thickenings at the micropylar tip called filiform apparatus, which play an important role in guiding the pollen tubes into the synergid.*



Mature Embyro sac of an angiosperms

- *After pollination, the incompatible pollens are rejected by the pistil as a result of pollen-pistil interaction. Compatible pollens germinate and growth of pollen tube takes place. It carries two male gametes in it. The pollen tube grows through the style and reaches the ovary. Once there, it enters the ovule through micropyle. One male gamete fuses with the egg cell (syngamy), while the other fuses with two polar nuclei to form primary endosperm nucleus (PEN). The zygote develops into an embryo while the PEN develops to form endosperm. These processes together are called double fertilization. After double fertilisation, the ovule matures into a seed while the ovary matures into a fruit. The ploidy of Endosperm (cotyledon) : triploid (3n) and Embryo : diploid (2n).*

OR

The process of double fertilization:

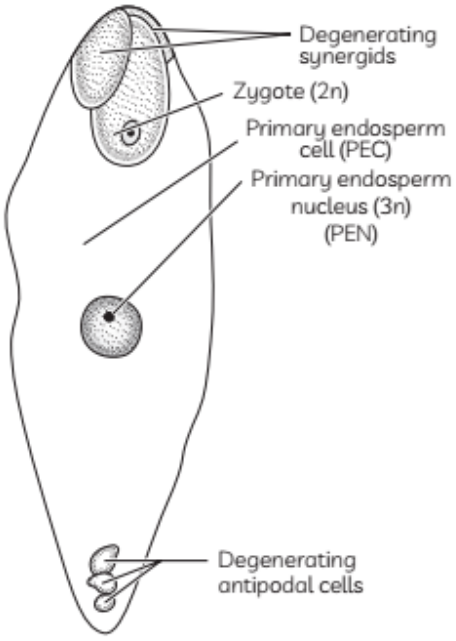
(1) After entering one of the synergids, the pollen tube releases the two male gametes into the cytoplasm of the synergid.

(2) One of the male gametes move towards the egg cell and fuses with its nucleus thus completing the syngamy. This results in the formation of a diploid cell, *i.e.*, the zygote.

(3) The other male gamete moves towards the two polar nuclei located in the central cell and fuses with them to produce a triploid primary endosperm nucleus (PEN).

(4) As this involves the fusion of three haploid nuclei hence, it is termed as triple fusion.

(5) The central cell after triple fusion becomes the primary endosperm cell (PEC) and develops into the endosperm while the zygote develops into an embryo.



(6) Since two types of fusions, syngamy and triple fusion take place in an embryo sac the phenomenon is termed as double fertilisation.

32. (A) The law of segregation states that during gamete formation the allele pair of a character segregates from each other without showing any blending of characters.

(B) The Mendelian F_2 phenotypic ratio in a dihybrid cross was 9:3:3:1. Based on this ratio, Mendel proposed the law of independent assortment.

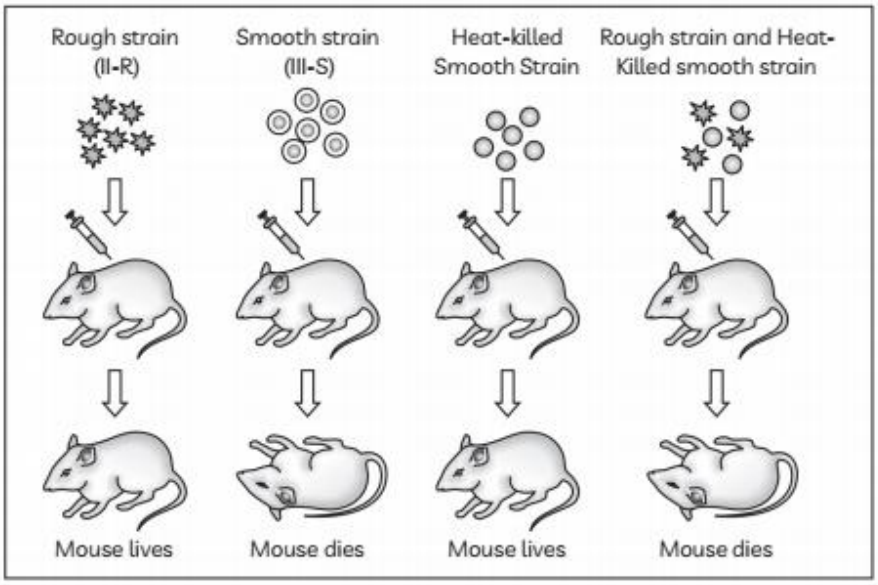
(C) Law of independent assortment states that when two pairs of traits are combined in a hybrid, segregation of one pair of characters is independent of the other pair of characters.

Thus, the two alleles of each character, after getting randomly assorted at the time of gamete formation, assort randomly at the time of fertilization, producing both parental and recombinant characters. This assortment is independent of the other alleles of different characters present. However, law of segregation is about separating alleles of a particular character at the time of gamete formation, *i.e*, each gamete has only one allele of any particular character.

OR

(A) The experiment to prove the 'transforming principle' was performed by Frederick Griffith on *Streptococcus pneumoniae* bacteria. He observed two types of strains of bacterium – smooth strain (which he called S-type) and rough strain (which he called R-type).

First, he injected live S-type cells into mice and observed that the mice died of pneumonia soon after. Then he injected live R-type cells into mice and observed that the mice survived. He then injected heat-killed S-type cells into mice and observed that the mice survived. But when he injected a mixture of heat-killed S-type cells and live R-type cells, the mice died of pneumonia. Thus, he concluded that a 'transforming principle' was responsible for transformation of the R-type cells into virulent S-type cells.



(B) Avery, MacLeod and McCarty extracted proteins, DNA and RNA from the heat-killed S-type cells. They found out that proteases (protein-digesting enzymes) and RNases (RNA digesting enzymes) had no effect on transformation but DNases (DNA digesting enzymes) inhibited the process. Thus, they concluded that the transforming principle is DNA.

33. (A) **Category (i):** All birds and mammals, and a very few lower vertebrate and invertebrate species are able to maintain homeostasis by physiological and behavioural means ensuring constant body temperature, constant osmotic concentration, *etc.* Hence, they come under the category of regulators.

Category (ii): In insects, fishes and lizards, the body temperature changes with the ambient temperature. In aquatic animals, the osmotic concentration of the body fluids change with that of the ambient air, water osmotic concentration. These animals and plants come under the category of conformers.

(B) **The strategy of suspension:** Bacteria, fungi and lower plants form various kinds of thick-walled spores which help them to survive unfavourable conditions. They germinate when suitable environment is

available. In higher plants, seeds and some other vegetative reproductive structures serve as means to tide over periods of stress besides helping in dispersal – they germinate to form new plants under favourable moisture and temperature conditions. They do so by reducing their metabolic activity and going into a state of 'dormancy'. A number of animals like bears go under hibernation (winter sleep) to tide over unfavourable conditions.

Related Theory

➥ *Some snails and fish go into aestivation to avoid summers and related problems like heat and dessication. Many zooplankton species in lakes and ponds are known to enter diapause, a stage of suspended development under unfavourable conditions.*

OR

(A) Birth rate = $\frac{10}{1000}$ = 0.01 offspring per person per year.

(B) In the month of June, there might be a lot of immigration from different areas or there might be a baby boom (more babies are born/expected randomly in some months of the year. In the month of July, there might be a lot of emigrations or mortalities.

(C) Mortality is the number of deaths in the population during a given period. Emigration is the number of individuals of the population who left the area and moved elsewhere during the time period under consideration.