CBSE Board
Class XII Biology
Board Paper
Term 1 - 2021

Time: 90 minutes **Total Marks: 35**

General Instructions:

Read the following instructions very carefully and strictly follow them:

*(i) This question paper contains **60** questions out of which **50** questions are to be attempted. **All** questions carry equal marks.*

*(ii) The questions paper consists **three** Sections - Section **A, B** and **C.***

*(iii) **Section - A** contains **24** questions. Attempt any **20** questions from Ques. No. **1** to **24**.*

*(iv) **Section - B** contains **24** questions. Attempt any **20** questions from Ques. No. **25** to **48**.*

*(v) **Section - C** contains **12** questions. Attempt any **10** questions from Ques. No, **49** to **60***

(vi) There is only one correct option for every Multiple Choice Questions (MCQs). Marks will not be awarded for answering more than one option.

(vii) There is not any negative marking.

SECTION-A

Section – A consists of **24** questions. Attempt any **20** questions from this section.
The first attempted **20** questions would be evaluated.

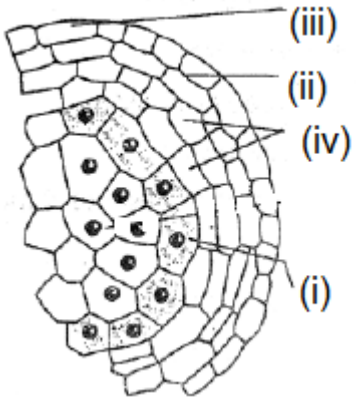
Question 1.

The hilum in a typical angiospermic ovule represents the junction between -

(a) Integuments and the embryo sac
(b) Embryo sac and the nucellus
(c) Body of the ovule and the funicle
(d) Nucellus and the funicle

Question 2.

In the given diagram of a transverse section of a young anther. Choose the labellings showing correct placement of the wall layers from the table given below:



	(i)	(ii)	(iii)	(iv)
(a)	Epidermis	Middle layers	Tapetum	Endothecium
(b)	Tapetum	Endothecium	Epidermis	Middle layers
(c)	Endothecium	Tapetum	Middle layers	Epidermis
(d)	Middle layers	Epidermis	Endothecium	Tapetum

Question 3.

The term used for the embryo entering into the state of inactivity as the seed mature is -

(a) Quiescent
(b) Parthenogenesis
(c) Parthenocarpy
(d) Dormancy

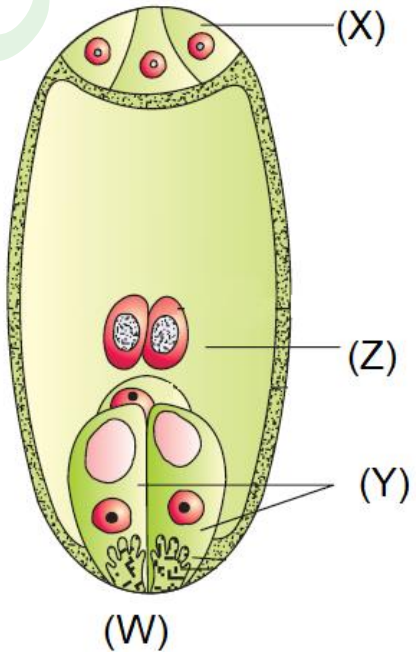
Question 4.

The ploidy of the apomictic embryo developed from the integument cells and megaspore mother cell without reduction division respectively will be -

(a) 2n and 2n
(b) n and n
(c) 2n and n
(d) 3n and 2n

Question 5.

Given below is a diagrammatic representation of a mature embryo sac of a typical angiosperm plant. Choose the option showing the correct labelling for the parts W, X, Y and Z from the table given below.



	W	X	Y	Z
(a)	Micropylar end	Antipodals	Synergids	Central cell
(b)	Chalazal end	Antipodals	Central cell	Synergids
(c)	Micropylar end	Synergids	Central cell	Antipodals
(d)	Chalazal end	Synergids	Central cell	Antipodals

Question 6.

Breast – feeding the baby acts as a natural contraceptive for the mother because it prevents:

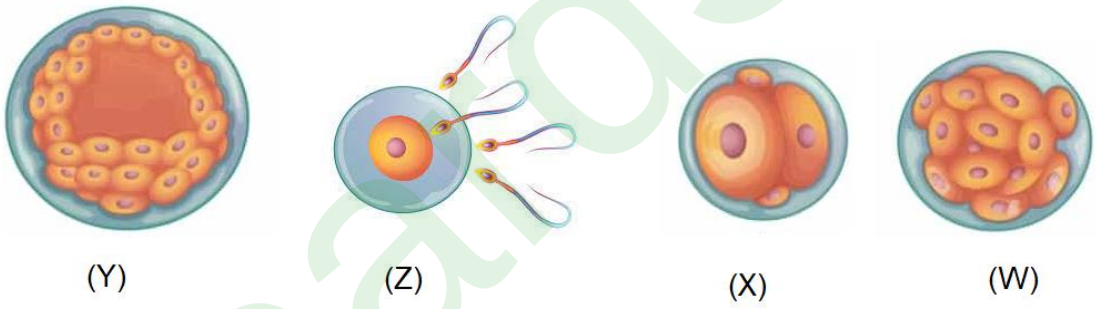
(i) Ovulation
(ii) Menstruation
(iii) Insemination
(iv) Fertilization

Choose the correct option:

(a) (ii) and (iv)
(b) (i) and (iii)
(c) (i) and (iv)
(d) (i) and (ii)

Question 7.

The given figure shows the different stages of human embryo.



Identify the correct labellings for W, X, Y and Z and choose the correct option from the table below:

	W	X	Y	Z
(a)	Cleavage	Blastocyst	Morula	Fertilization
(b)	Blastocyst	Morula	Cleavage	Fertilization
(c)	Morula	Cleavage	Blastocyst	Fertilization
(d)	Morula	Blastocyst	Cleavage	Fertilization

Question 8.

During human embryonic development the external genital organs are well developed in the fetus by the end of -

(a) 6 weeks of pregnancy
(b) 12 weeks of pregnancy
(c) 18 weeks of pregnancy
(d) 24 weeks of pregnancy

Question 9.

The accessory ducts in the human male reproductive system consists of -

(a) Epididymis, Prostrate, Rete testis

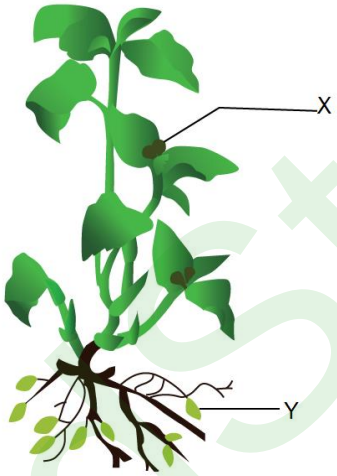
(b) Rete testis, Vas efferentia, Seminal vesicles

(c) Vas efferentia, Bulbourethral, Epididymis

(d) Rete testis, epididymis, Vas deferens

Question 10.

Given below is a figure of an angiosperm plant showing two different types flowers 'X' and 'Y' and the possible type of pollination in them:



Select the correct option for the flower (X) and flower (Y) and the possible type of pollination from the given table:

	Flower X	Flower Y
(a)	Chasmogamous, assured seed set	Cleistogamous, cross pollination
(b)	Cleistogamous self/cross pollination	Chasmogamous, assured seed set
(c)	Chasmogamous, self/cross pollination	Cleistogamous, self pollination
(d)	Cleistogamous self pollination only	Chasmogamous, cross pollination only

Question 11.

An undifferentiated sheath covering the root cap of a monocotyledonous embryo is

(a) Scutellum

(b) Coleorhiza

(c) Coleoptile

(d) Epiblast

Question 12.

The Cause of Down's syndrome in humans is:

(a) Extra copy of an autosome

(b) Extra copy of a sex chromosome

(c) Absence of an autosome

(d) Absence of a sex chromosome

Question 13.

What of the following features show the mechanism of sex determination in honey – bee?

(i) An offspring formed from the union of a sperm and egg develops as a male.
(ii) Males have half the number of chromosomes than that of female.
(iii) The females are diploid having 32 chromosomes.
(iv) Males have father and can produce sons.

(a) (i) and (ii)
(b) (ii) and (iii)
(c) (i) and (iv)
(d) (ii) and (iv)

Question 14.

Select the pair that is incorrect:

(a) Sickle-cell anemia : Autosome linked recessive trait
(b) Haemophilia : Autosome linked recessive trait
(c) Colour blindness : Sex linked recessive trait
(d) Thalassemia : Autosome linked recessive trait

Question 15.

An example of a human trait where a single gene can exhibit multiple phenotypic expression is -

(a) Phenyl ketonuria
(b) Cystic fibrosis
(c) Thalassemia
(d) Haemophilia

Question 16.

Life cycle of Drosophila melanogaster is completed in -

(a) 7 days
(b) 14 days
(c) 21 days
(d) 28 days

Question 17.

How many types of gametes would develop by an organism with genotypes AaBBCcDD?

(a) 1
(b) 2
(c) 3
(d) 4

Question 18.

Given below are the observations drawn in HGP. Select the option that shows the correct observations.

(i) The human genome contains 3164.7 billion base pairs.
(ii) The average gene consists of 3000 bases.
(iii) Less than 2% of the genome codes for proteins.
(iv) Chromosome one has most genes (2698).

(a) (i) and (ii)
(b) (ii) and (iii)
(c) (iii) and (iv)
(d) (i) and (iii)

Question 19.

The phosphoester linkage in the formation of a nucleotide involves the bonding between

(a) Phosphate group and OH of 3'C of a nucleoside
(b) Phosphate group and OH of 5'C of a nucleoside
(c) Phosphate group and H of 3'C of a nucleoside
(d) Phosphate group and H of 5'C of a nucleoside

Question 20.

The switching 'on' and 'off' of the lac operon in prokaryotes is regulated by

(a) Glucose
(b) Galactose
(c) Lactose
(d) Fructose

Question 21.

For 'in-vitro' DNA replication, which one of the following substrates need to be added along with the necessary enzymes, the DNA template and specific conditions?

(a) Ribonucleotide triphosphate
(b) Deoxyribonucleoside triphosphate
(c) Deoxyribonucleotide triphosphate
(d) Ribonucleoside triphosphate

Question 22.

Which one of the following factor will associate transiently with RNA polymerase to terminate transcription in prokaryotes?

(a) sigma factor
(b) RHO factor
(c) Delta Factor
(d) Theta factor

Question 23.

Choose the correct pair of codon with its corresponding amino acid from the following list:

(a) UAG: Glycine
(b) AUG: Arginine
(c) UUU: Phenylalanine
(d) UGA : Methionine

Question 24.

During elongation process of translation, the peptide bond formation between amino acids is catalysed by -

(a) ribosomal RNA
(b) Protein in small subunit of ribosome
(c) Protein in large subunit of ribosome
(d) transfer RNA

SECTION - B

Section - **B** consists of **24** questions (Sl. No.**25** to **48**). Attempt any 20 questions from this section.
The first attempted **20** questions would be evaluated.
Question No. **25** to **28** 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

Question 25.

Assertion (A): Through Reproductive and Child Health (RCH) programmes in India, we could bring down the population growth rate.
Reason (R): A rapid increase in MMR and IMR were the reasons, along other reasons for this.

Question 26.

Assertion (A): Sterilisation methods are generally advised for male/ female partner as a terminal method to prevent any more pregnancies.
Reason (R): These techniques are less effective and have high reversibility.

Question 27.

Assertion (A): The inner cell mass of blastocyst gets attached to the endometrium during embryonic development in humans.
Reason (R): The blastomeres in the blastocyst gets arranged into trophoblast and inner cell mass.

Question 28.

Assertion (A): There is expression of only one gene of the parental character in a Mendelian Monohybrid cross in F_1 generation.

Reason (R): In a dissimilar pair of factor one member of the pair dominates the other.

Question 29.

Select the correct option for Human Chorionic Gonadotropin (HCG) released during embryonic development in humans.

1.Helps in maintains of pregnancy.
2.Leads to rupture of Graafian follicle.
3.Cause strong uterine contraction during childbirth.
4.Brings metabolic changes in the mother.

(a) (i) and (ii)
(b) (i) and (iv)
(c) (ii) and (iii)
(d) (ii) and (iv)

Question 30.

Residual persistent nucellus in black pepper is known as

(a) Perisperm
(b) Pericarp
(c) Pulvinus
(d) Perianth

Question 31.

Amongst the insects the dominant biotic pollinating agents are –

(a) Ants
(b) Wasps
(c) Beetles
(d) Bees

Question 32.

The source of gonadotropin LH and its corresponding function is

(a) Anterior pituitary, ovulation
(b) Anterior pituitary Graafian follicle formation
(c) Hypothalamus Ovulation
(d) Hypothalamus, Graafian follicle formation

Question 33.
A specialized procedure to form an embryo in the laboratory in which sperm is directly, injected into the ovum is
(a) IUT
(b) IUI
(c) ICSI
(d) ZIFT

Question 34.
Listed below are all reproductive tract infections except
(a) Genital herpes
(b) Filariasis
(a) Trichomoniasis
(b) Syphilis

Question 35.
A genetic mechanism which prevents inbreeding depression in majority of angiospermic plants is
(a) Parthenogenesis
(b) Parthenocarpy
(c) Mutation
(d) Self-incompatibility

Question 36.
In *Pisum sativum* the flower colour may be Violet (V) or White (v). What proportion of the offspring in a cross of VV × vv would be expected to be violet?
(a) 25%
(b) 50%
(c) 75%
(d) 100%

Question 37.
Which one of the gene pair is expected to give a ratio of 1:1:1:1 in the progeny of a Mendelian Dihybrid cross?
(a) AaBb × AaBb
(b) AABB × AaBb
(c) AaBb ×aabb
(d) AABB × aabb

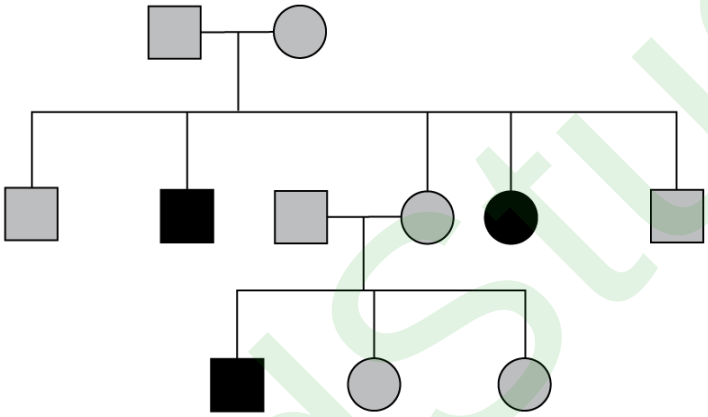
Question 38.

The progeny of a cross between two snap dragon plants, heterozygous for flower colour, bearing different coloured flower would be:

(a) 50% pink,50% white
(b) 25% red, 50% pink, 25% white
(c) 50% red, 50% white
(d) 75% red, 25% white

Question 39.

Study the given pedigree of a family and select the trait that shows this pattern of inheritance:



(a) Autosomal recessive, Phenylketonuria
(b) Sex –linked recessive, colour- blindness
(c) Autosomal dominant, Myotonic dystrophy
(d) Sex – linked dominant, Vitamin – D resistant Rickets

Question 40.

A child with blood Group A has father with blood group B and mother with blood group AB. What would be the possible genotypes of parents and the child? Choose the correct option:

	Father	**Mother**	**Child**
(a)	I^Ai	I^Bi	I^Ai
(b)	I^AI^B	I^Ai	I^AI^A
(c)	I^Bi	I^AI^B	I^Ai
(d)	I^BI^B	I^AI^B	I^AI^A

Question 41.

In a dihybrid Mendelian cross, garden pea plants heterozygous for violet flowers and round seeds are crossed with homozygous, white and wrinkled seeds. The genotypic and phenotypic ratio of F_1 progeny would be.

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

Question 42.
A region of coding strand of DNA has the following nucleotide sequence:
5' - TGCGCCA -3'
The sequence of bases on mRNA transcribed by this DNA strand would be:
(a) 3' — ACGC0GT — 5'
(b) 5' — ACGCGGT — 3'
(c) 5' — UGCGCCA — 3'
(d) 3' — UGCGCCA —5'

Question 43.
A DNA molecule is 160 base pairs long. It has 20% adenine. How many cytosine bases are present in this DNA molecule?
(a) 192
(b) 96
(c) 64
(d) 42

Question 44.
A template strand in a bacterial DNA has the following base sequence:
5' — TTTAACGAGG - 3'
What would be the RNA sequence transcribed from this template DNA?
(a) 5'— AAATTGCTCC — 3'
(b) 3'— AAATTGCTCC — 5'
(c) 3 '— AAAUUCCUCC — 3'
(d) 5'— CCUCGUUAAA — 3'

Question 45.
Colour-blindness is a sex linked recessive trait in humans. A man with normal colour vision marries a women who is colourblind. What would be the possible genotypes of the parents, the son and the daughter of this couple?

	Mother	Father	Daughter	Son
(a)	XX	X^eY	X^CX	XY
(b)	X^CX^C	X^eY	X^CX^C	X^CY
(c)	X^CX	XY	X^CX	XY
(d)	X^CX^C	XY	X^CX	X^CY

Question 46.
tRNA has an _____ that has bases complementary to the codon, its actual structure is a compact molecule which looks like _____. Select the option that has correct choices for the two blanks.
(a) amino acid acceptor end, clover-leaf
(b) anticodon loop, clover-leaf
(c) amino acid acceptor end, inverted L
(d) anticodon loop, inverted L

Question 47.

Which type of RNA is correctly paired with its function?

(a) small nuclear RNA: Possesses rRNA
(b) transfer RNA : attaches to amino acid
(c) ribosomal RNA : involved in transcription
(d) micro RNA : involved in translation

Question 48.

Given below are the pairs of contrasting traits in *Pisum sativum* as studied by Mendel. Select the incorrectly mentioned option from the table given below:

	Character	Dominant	Recessive
(a)	Flower position	Terminal	Axial
(b)	Seeds shape	Round	Wrinkled
(c)	Pod colour	Green	Yellow
(d)	Pod shape	Constricted	Inflated

SECTION –C

Section –C consists of one rage followed by **6** questions linked to this case (Q. No. **49** to **54**). Besides this, **6** more questions are given. Attempt any **10** questions in this section.
The first attempted **10** questions would be evaluated.

Case:

A women of 35 years age with a married life of eight years and having normal reproductive cycles visits a doctor along with her husband for consultation for infertility. They were not using any contraceptive methods. They have no child. The doctor advises them alter a detailed physical examination of both of them to undergo following investigations:

- Seminal analysis of the husband
- Follicular study of the wife
- Blood test for Follicle Stimulating Hormone (FSH) estimation for both.

With your basic knowledge of human embryology and the case given above, answer the following questions (**49-54**):

Question 49.

Seminal analysis of the husband was done for determining

(i) Sperm morphology and sperm count
(ii) Quantity and pH of semen
(iii) Rate of sperm release into the Vagina

(a) (i) only
(b) (i) and(ii)
(c) (ii) and (iii)
(d) (ii) only

Question 50.
An ultrasound - guided follicular study was done for the wife for determining the size and physical appearance of the
(a) Ovary
(b) Oogonia
(c) Antral follicles
(d) Corpus Luteum

Question 51.
The blood test report of the wife showed low FSH value, which is indicative of -
(a) low rate of formation of ovarian follicles
(b) high rate of formation of ovarian follicles
(c) low rate of maturation of ovarian follicles
(d) high rate of maturation of ovarian follicles

Question 52.
In the above case if the husband is found to have sperm count of less than 20 million/mL and the wife is diagnosed with blockage in the oviduct, the couple would be advised for:
(i) ZIFT
(ii) Al
(iii) IVF
(iv) ICST
(a) (i) and (iii)
(b) (ii) and (iii)
(c) (iii) and (iv)
(d) (i) and (iv)

Question 53.
The high level of which gonadotropin/ovarian hormone in the blood sample of the wife taken on day 20 of her reproductive (menstrual) cycle would indicate the luteal phase of the ovarian cycle ?
(a) FSH
(b) LH
(c) Estrogens
(d) Progesterone

Question 54.
In which phase of the menstrual cycle is the blood sample of a women taken if, on analysts. It shows high levels of L.H. and estrogen?
(a) Ovulatory phase
(b) Menstrual phase
(c) Secretory phase
(d) Follicular phase

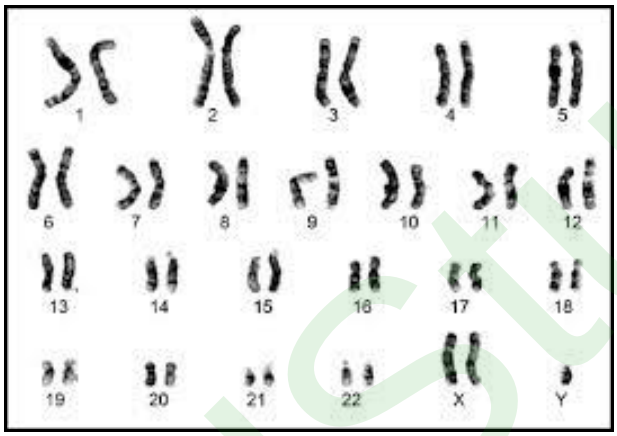
Question 55.

How many types of gametes can be produced in a diploid organism which is heterozygous for 4 loci?

(a) 1
(b) 8
(c) 16
(d) 32

Question 56.

Given below a Karyotype obtained after analysis of fetal cells for probable genetic disorder.



Based on the above karyotype, the chromosomal disorder detected in unborn foetus and the consequent symptoms the child may suffer from are-

(a) Down's syndrome : Gynaecomastia, overall masculine development
(b) Down's syndrome : Furrowed tongue, short stature
(c) Klinefelter's syndrome : Gynaecomastia, Masculine development
(d) Klinefelter's syndrome : Rudimentary ovaries, short stature

Question 57.

The recombinant frequency between the four linked genes is as follows:

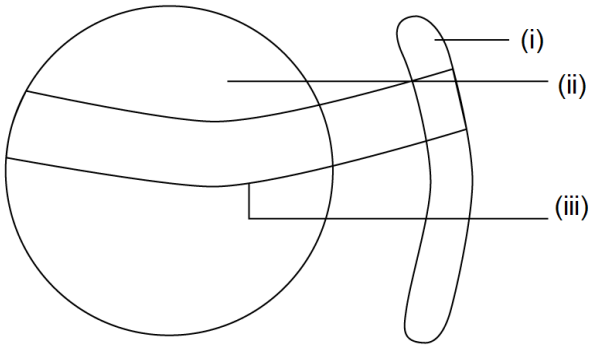
(i) between X and Y is 40%.
(ii) between Y and Z is 30%
(iii) between Z and W is 10%
(iv) between W and X is 20%

Select the option that shows the correct order of the position of W, X, Y and Z genes on the chromosome:

(a) Y - X – Z - W
(b) Y – W – Z - X
(c) X – Y - Z - W
(d) Z – X – Y - W

Question 58.

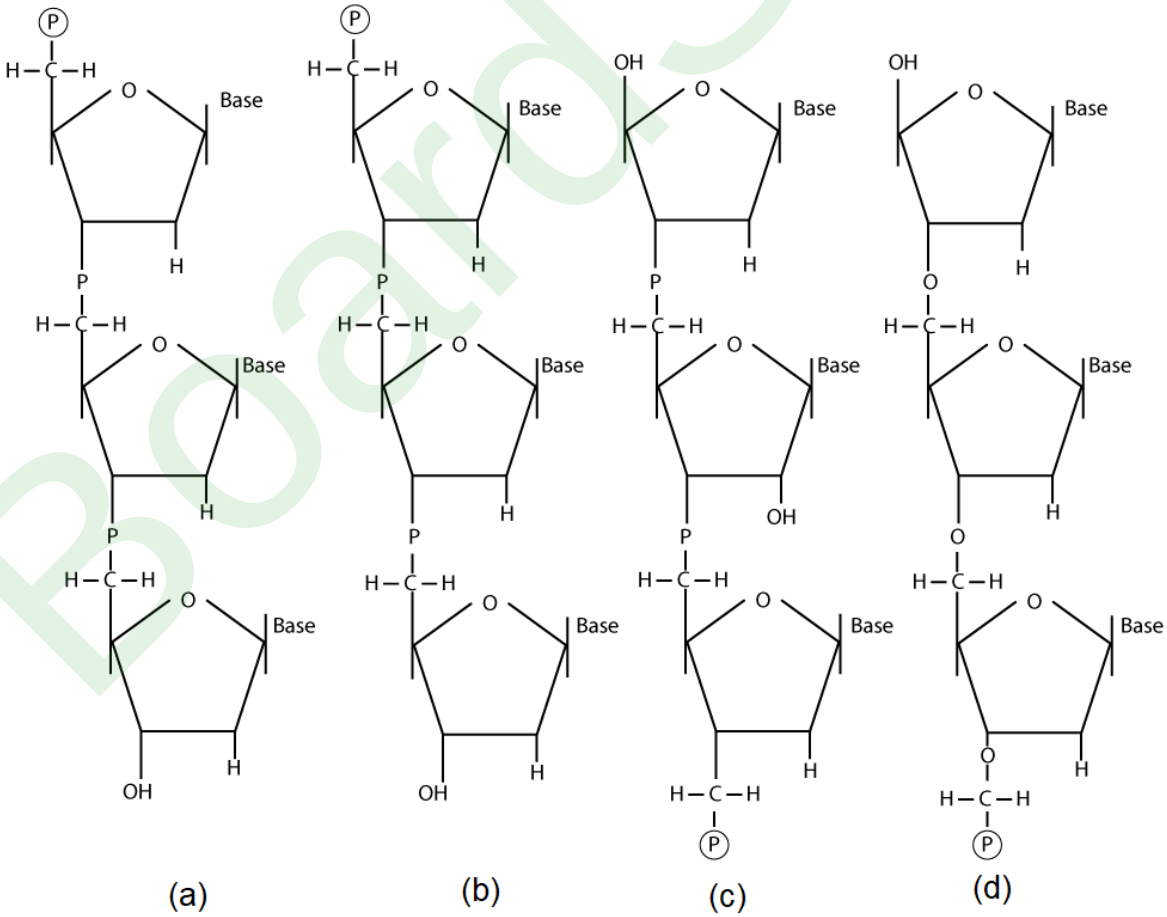
The figure given below has labellings (i), (ii) and (iii), which two labellings in the given figure are components of a nucleosome? Select the correct option.



(a) (i) - HI histone, (ii) - DNA
(b) (i) - DNA, (ii) - Historic Octamer
(c) (ii) - DNA, (iii) - HI Histone
(d) (ii) - Histone octamer, (iii) - DNA

Question 59.

Which one of the following diagram is a correct depiction of a polynucleotide chain to DNA?



Question 60.

In molecular biology who proposed that genetic information flows in one direction?

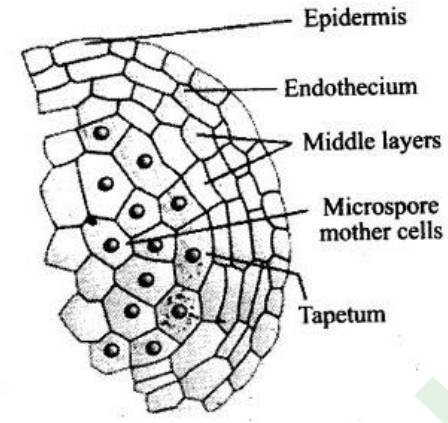
(a) Hargobind Khorana
(b) Francis Crick
(c) Watson and Crick
(d) Marshall Nirenberg

Solution

SECTION-A

Ans 1.
Correct option – c: Body of the ovule and the funicle
The point of attachment of funicle to the body of the ovule is known as hilum.

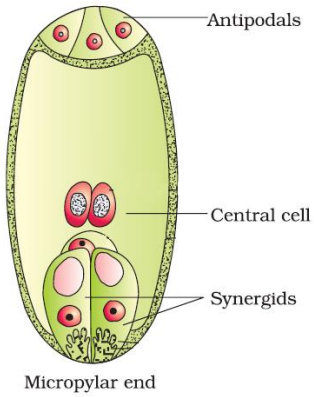
Ans 2.
Correct option – b: (i) – Tapetum, (ii) – Endothecium, (iii) – Epidermis, (iv) – Middle layers



Ans 3.
Correct option – d: Dormancy
In dormancy, the seed is in a state of apparent inactivity and will not grow even if favorable conditions are provided, until a definite time has elapsed.

Ans 4.
Correct option – a: 2n and 2n
The apomictic embryo and megaspore mother cell will be diploid with ploidy 2n and 2n respectively.

Ans 5.
Correct option – a: W – Micropylar end, X - Antipodals, Y – Synergids, Z – Central cell



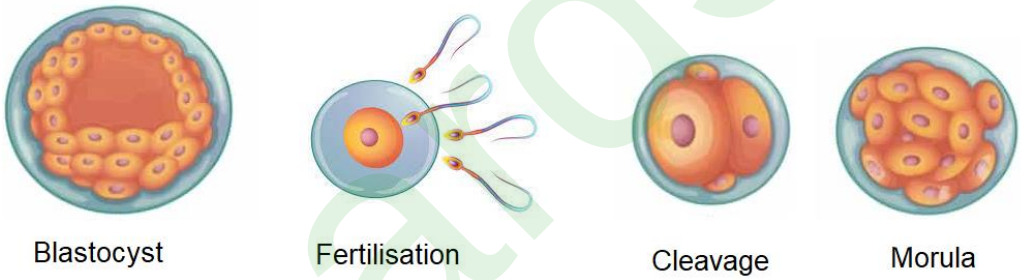
Ans 6.

Correct option – d: (i) and (ii)

Breastfeeding the baby acts as a natural contraceptive for the mothers because during lactation there is the decrease in the production of FSH and LH by the pituitary gland which is not enough to trigger the process of ovulation. Hence, ovulation and menstruation do not occur which in turn acts as a natural contraceptive for a mother.

Ans 7.

Correct option – c: W – Morula, X - Cleavage, Y – Blastocyst, Z – Fertilisation



Ans 8.

Correct option – b: 12 weeks of pregnancy

During human embryonic development the external genital organs are well developed in the fetus by the end of 12 weeks of pregnancy.

Ans 9.

Correct option – d: Rete testis, epididymis, vas deferens

Vasa efferentia, epididymis, vas deferens, and rete testis are the male accessory ducts and they play an important role in the transport and temporary storage of sperms.

Ans 10.

Correct option – c: Flower X – Chasmogamous, self/cross pollination, Flower Y – Cleistogamous, self pollination

Chasmogamous flowers are usually cross-pollinated. Cleistogamous flowers can only carry out self-pollination.

Ans 11.
Correct option – b: Coleorhiza
Coleorrhiza is an undifferentiated sheath that encloses the radicle and the root cap in a monocot seed.

Ans 12.
Correct option – a: Extra copy of an autosome
In Down's syndrome caused by trisomy 21, the person has three copies of chromosome 21, instead of the usual two copies, in all cells.

Ans 13.
Correct option – b: (ii) and (iii)
Honeybees show haplodiploid method of sex determination. Haplodiploidy is a sex determination mechanism in which males develop from unfertilised eggs and are haploid. The females develop from fertilised eggs and are diploid having 32 chromosomes.

Ans 14.
Correct option – b: Haemophilia: Autosome linked recessive trait
Haemophilia A and haemophilia B are inherited in an X-linked recessive pattern.

Ans 15.
Correct option – a: Phenyl ketonuria
An example of a human trait where a single gene can exhibit multiple phenotypic expression is pleiotropy. A common example of pleiotropy is the human disease phenylketonuria (PKU).

Ans 16.
Correct option – b: 14 days
Life cycle of *Drosophila melanogaster* is completed in 14 days.

Ans 17.
Correct option- d: 4
4 types of gametes would develop by an organism with genotypes AaBBCcDD – ABCD, ABcD, aBCD, aBcD.

Ans 18.
Correct option- b: (ii) and (iii)
According to HGP, the average gene consists of 3000 bases. Less than 2% of the genome codes for proteins.

Ans 19.
Correct option – b: Phosphate group and OH of 5′C of a nucleoside
The phosphoester linkage in the formation of a nucleotide involves the bonding between the phosphate group and OH of 5′C of a nucleoside.

Ans 20.
Correct option- c: Lactose
Lactose is the substrate for the enzyme beta galactosidase and it regulates switching on and off of the operon. It is termed as inducer.

Ans 21.
Correct option – c: Deoxyribonucleotide triphosphate
Deoxyribonucleoside triphosphate serves as a substrate in polymerisation and also provides energy to the reaction i.e. energy source.

Ans 22.
Correct option b: RHO factor
As a molecule, Rho is a RNA/DNA helicase or translocase that dissociates RNA polymerase from DNA template to release RNA, deriving energy by hydrolyzing ATP through its RNA-dependent ATPase activity to bring about termination.

Ans 23.
Correct option c: UUU: Phenylalanine
UAG codes for amber or stop codon, AUG codes for methionine and UGA codes for opal or stop codon.

Ans 24.
Correct option a: ribosomal RNA
During elongation process of translation, the peptide bond formation between amino acids is catalysed by ribosomal RNA.

SECTION – B

Ans 25.
Correct option – c; (A) is true but (R) is false.
i) If IMR has been increased then it will result in a decline in growth rate.
ii) While decreased MMR will cause a rapid increase in growth rate.

Ans 26.
Correct option – c; (A) is true but (R) is false.
Surgical methods of contraception are called sterilization methods or terminal methods as these procedures makes an individual incapable of further production and are highly effective.

Ans 27.
Correct option – d; (A) is false but (R) is true.
During implantation, the trophoblast layer gets attached to the endometrium. The inner cell mass of the blastocyst gets differentiated as embryo.

Ans 28.
Correct option – a; Both (A) and (R) are true and (R) is the correct explanation of (A).
In a dissimilar pair of factors, the dominant member of the pair gets expressed and the recessive member gets suppressed. Hence, there is expression of only one gene of the parental character in a Mendelian monohybrid cross in F_1 generation.

Ans 29.
Correct option – b: (i) and (iv)
Human Chorionic Gonadotropin (HCG) released during embryonic development in humans helps to maintain pregnancy and brings about metabolic changes in the mother.

Ans 30.
Correct option – a: Perisperm
In black pepper and beet, nucellus is not completely used up during the development of an embryo and residual persistent nucellus is called perisperm.

Ans 31.
Correct option – d: Bees
Among the animals, insects particularly bees are the dominant pollinating agents.

Ans 32.
Correct option – a: Anterior pituitary, ovulation
Gonadotropin LH is secreted by the anterior pituitary. LH in synergy with follicle stimulating hormone (FSH) stimulates follicular growth and ovulation.

Ans 33.
Correct option – c: ICSI
Intracytoplasmic sperm injection (ICSI) is an in vitro fertilization (IVF) procedure in which a single sperm cell is injected directly into the cytoplasm of an egg.

Ans 34.
Correct option – b: Filariasis
Filariasis is an infectious tropical disease caused by any one of several thread-like parasitic round worms.

Ans 35.
Correct option – d: Self-compatibility
One of the most important mechanisms used by higher plants to prevent inbreeding and to promote outcrossing utilizes a sophisticated genetic mechanism of control, called self-incompatibility (SI).

Ans 36.
Correct option – d: 100%
When violet flowers (VV) are crossed with white flowers (vv), the progeny obtained are with the genotype (Vv) and phenotype as violet flowers. So, 100% of the progeny are with violet flowers (Vv).

Ans 37.
Correct option – c: AaBb × aabb
1:1:1:1 is the phenotypic ratio which is classic Mendelian ratio for a test cross in which the alleles of the two genes assort independently into gametes. It is a test done to investigate the genotype of parents.

Ans 38.
Correct option – b: 25% red, 50% pink, 25% white
In snapdragon a cross between true breeding red flowered plant (RR) and true breeding white flowered plant (rr) will result in the progeny being heterozygous (Rr) and having pink flowers. Neither of the traits are dominant over the other and one allele does not mask the effect of the other. As a result, the phenotypic result is a blend in expression of the two phenotypes resulting in pink flowered plants (a third different phenotype). It is therefore a form of intermediate inheritance.

Ans 39.
Correct option a: Autosomal recessive, Phenylketonuria
Phenylketonuria is inherited in families in an autosomal recessive pattern. Autosomal recessive inheritance means that a person has two copies of the gene that is altered. Usually, each parent of an individual who has phenylketonuria carries one copy of the altered gene.

Ans 40.

Correct option – c: Father – I^Bi, Mother – I^AI^B, Child - I^Ai

The ABO gene has three types of alleles: A, B, and O. The first two, A and B, are codominant, in other words, they dominate equally. However, allele O is recessive. Mother has blood group AB, so her genotype is I^AI^B. Father has blood group B, so his genotype would be I^Bi and child has blood group A, so his genotype would be I^Ai.

Ans 41.

Correct option – c: 1 : 1 : 1 : 1

Garden pea plants heterozygous for violet flowers and round seeds (VvRr) are crossed with homozygous, white and wrinkled seeds (vvrr). So, the genotypic and phenotypic ratio of F1 progeny would be 1 : 1 : 1 : 1.

Ans 42.

Correct option – c: 5′ - UGCGCCA - 3′

The sequence of bases on mRNA transcribed by the DNA strand 5′ - TGCGCCA -3' would be 5′ - UGCGCCA - 3′.

Ans 43.

Correct option- d: 42

The amount of adenine is always equal to that of thymine, and the amount of guanine is always equal to that of cytosine. 50% is the purine content and 50% is the pyrimidine content.

Ans 44.

Correct option- c: 3′ - AAAUUGCUCC - 5′

RNA sequence transcribed from the template DNA 5' — TTTAACGAGG - 3' will have the sequence 3′ - AAAUUGCUCC - 5′.

Ans 45.

Correct option – d: Mother – X^CX^C, Father – XY, Daughter – X^CX, Son – X^CY

Man with normal colour vision (XY) and woman is colourblind (X^CX^C). So, the daughter would be a carrier (X^CX) and the son would be colourblind (X^CY).

Ans 46.

Correct option- d: anticodon loop, inverted L

tRNA has an anticodon loop that has bases complementary to the codon, its actual structure is a compact molecule which looks like inverted L.

Ans 47.
Correct option- b: transfer RNA: attaches to amino acid
Small nuclear RNA: Processing of pre-messenger RNA (hnRNA) in the nucleus.
Ribosomal RNA: Ensures the proper alignment of the mRNA and the ribosomes during protein synthesis and catalyzes the formation of the peptide bonds.
Micro RNA: Play important roles in post-transcriptional gene regulation.

Ans 48.
Correct option- d: Character – Pod shape, Dominant – Constricted, Recessive – Inflated
With respect to pod shape, inflated pods are dominant over constricted pods which are recessive.

SECTION – C

Ans 49.
Correct option – b: (i) and (ii)
Seminal analysis is done to determine sperm morphology and sperm count and also the quantity and pH of semen.

Ans 50.
Correct option – a: Ovary
An ultrasound - guided follicular study helps in determining the size and physical appearance of the ovary.

Ans 51.
Correct option – a: low rate of formation of ovarian follicles
Low FSH value indicates low rate of formation of ovarian follicles.

Ans 52.
Correct option – a: (i) and (iii)
ZIFT stands for zygote intra-fallopian transfer. This is a modification of the standard IVF procedure. ZIFT is identical to IVF throughout ovarian stimulation, egg retrieval, and fertilization. The only difference is when the embryos are replaced, and also where they are placed during the transfer procedure.

Ans 53.
Correct option – d: Progesterone
During the luteal phase of the ovarian cycle, the hormone progesterone reaches its peak levels.

Ans 54.
Correct option – a: Ovulatory phase
High levels of L.H. and estrogen are seen in the ovulatory phase of the menstrual cycle.

Ans 55.
Correct option – c: 16
Types of gametes produced by organism= 2n wherein n= number of loci for which the organism is heterozygous.
The given diploid organism is heterozygous for 4 loci, types of gametes produced $=2^4 = 16$.

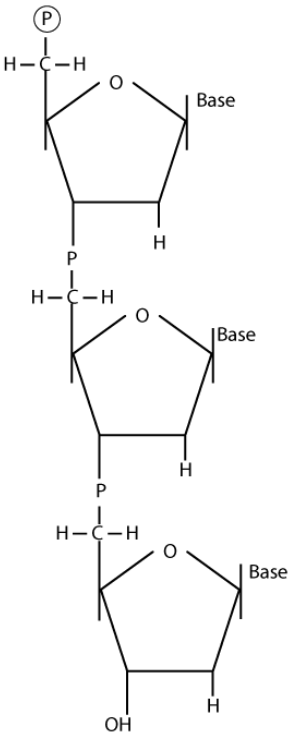
Ans 56.
Correct option – c: Klinefelter's syndrome : Gynaecomastia, Masculine development
Males who have Klinefelter's syndrome may have a small, firm testes, a small penis, sparse pubic, armpit and facial hair, enlarged breasts (called gynecomastia), tall stature, and abnormal body proportions (long legs, short trunk).

Ans 57.
Correct option – b: Y – W – Z - X
The recombination frequencies for many gene pairs helps us create linkage maps that show the order and relative distances of the genes on the chromosome. The strength of linkage between two genes depends upon the distance between the genes on the chromosome.

Ans 58.
Correct option – d: (ii) – Histone octamer, (iii) – DNA
(i) – H_1 histone, (ii) - Histone octamer, (iii) - DNA

Ans 59.

Correct option – b:



Ans 60.

Correct option – c: Watson and Crick

Watson and Crick proposed that genetic information flows in one direction.

CBSE Board Paper Solution-2020

Class	**: XII**
Subject	**: Biology**
Set	**: 1**
Code No	**: 57/3/1**
Time allowed	**: 3 hours**
Maximum Marks	**: 80**

General Instructions :

Read the following instructions very carefully and strictly follow them :

(i) *Question paper comprises five sections – **A, B, C, D** and **E**.*

(ii) *There are **27** questions in the question paper. **All** questions are compulsory.*

(iii) ***Section A** – Questions no. **1** to **5** are multiple choice questions, carrying **1** mark each.*

(iv) ***Section B** – Questions no. **6** to **12** are short-answer questions type-I, carrying 2 marks each.*

(v) ***Section C** – Questions no. **13** to **21** are short-answer questions type-II, carrying 3 marks each.*

(vi) ***Section D** – Questions no. **22** to **24** are short-answer questions type-III, carrying 3 marks each.*

(vii) ***Section E** – Questions no **25** to **27** are long-answer questions, carrying 5 marks each.*

(viii) *Answers should be brief and to the point.*

(ix) *There is no overall choice in the question paper. However, an internal choice has been provided in **two** questions of 1 mark, **one** question of **2** marks, two questions of 3 marks and **three** questions of 5 marks. Only one of the choices in such questions have to be attempted.*

(x) *The diagrams drawn should be neat, proportionate and properly labelled, wherever necessary.*

(xi) *In addition to this, separate instructions are given with each section and question, wherever necessary.*

SECTION A

Note:- *Choose the correct option from the choices given in each of the following questions :*

1) Introduction of an alien DNA into a plant host cell is achieved by making them

(A) Competent with bivalent ions
(B) Using microinjections
(C) Using gene gun
(D) Using lysozymes and chitinase

[1]

Answer:

(C) Using gene gun

Explanation:

Alien DNA can be introduced to host cell by both microinjections and gene gun methods. From these two methods, gene gun method is suitable for plant host cells. In gene gun method, cells are bombarded with high velocity DNA coated gold or tungsten micro-particles.

2) One of the ex situ conservation methods for endangered species is

(A) Biosphere reserves
(B) National parks
(C) Cryopreservation
(D) Wildlife sanctuaries

[1]

Answer:

(C) Cryopreservation

Explanation:

Cryopreservation is an ex situ method as it involves the conservation of endemic plants or animals in liquid nitrogen at -196^{o}C.

OR

2) Ozone gas is continuously formed in the stratosphere by

(A) Action of UV rays on nascent oxygen
(B) Reaction of oxygen with water vapour
(C) Action of UV rays on molecular oxygen

(D) Action of UV rays on water vapour

[1]

Answer:

(C) Action of UV rays on molecular oxygen

Explanation:

Ozone gas is continuously formed in the stratosphere by the action of UV rays on molecular oxygen. The degradation of ozone molecule into oxygen molecule and nascent oxygen also takes place continuously in the stratosphere to maintain the balance between the production and degradation of ozone in the stratosphere.

3) Intense lactation in mothers acts as a natural contraceptive due to the

(A) Suppression of gonadotropins
(B) Hypersecretion of gonadotropins
(C) Suppression of gametic transport
(D) Suppression of fertilization

[1]

Answer:

(A) Suppression of gonadotropins

Explanation:

Intense lactation in mothers acts as a natural contraceptive due to the suppression of gonadotrophins.

During lactation, the amount of oestrogen produced by the lactating mother is very less than normal which restricts the process of ovulation. Therefore, no menstrual cycle occurs in the intense lactation.

4) The principle of vaccination is based on the property of

(A) Specificity
(B) Diversity
(C) Memory
(D) Discrimination between 'self' and 'non-self'

[1]

Answer:

(C) Memory

Explanation:

The principle of vaccination is based on the property of memory. In vaccination, attenuated pathogen is supplied into the normal healthy body. By vaccination, the healthy human body produces antibodies along with memory B-cells and T-cells. When vaccinated person later attacked by the same pathogen, the existing memory B-cells and T-cells recognise the antigen and destroys the pathogen by producing antibodies and lymphocytes.

OR

4) Opioids act as

(A) Depressants

(B) Pain Killers
(C) Euphoria providers
(D) Stimulants

[1]

Answer:

(A) Depressants

Explanation:

Opioids are the special drugs that binds with the specific opioid receptors present in our central nervous system and gastrointestinal tract. They are generally depressant and they work by slowing down the body functions.

5) Nematode specific genes were introduced into the tobacco host plant by using the vector

(A) Plasmid
(B) Bacteriophage
(C) pBR 322
(D) Agrobacterium

[1]

Answer:

(D) *Agrobacterium*

Explanation:

Nematodes specific genes were introduced into tobacco plant by using the vector agrobacterium. Nematode-

specific genes were introduced into the host plants using agrobacterium to produce both sense and antisense RNA in the host cells. The parasite cannot survive in the transgenic host thus, prevents the plants from getting attacked.

SECTION B

6) *Spirulina* is a rich source of proteins. Mention the two ways by which large scale culturing of these microbes is possible.

[2]

Answer:

The two ways by which large scale culturing of these microbes is possible are:

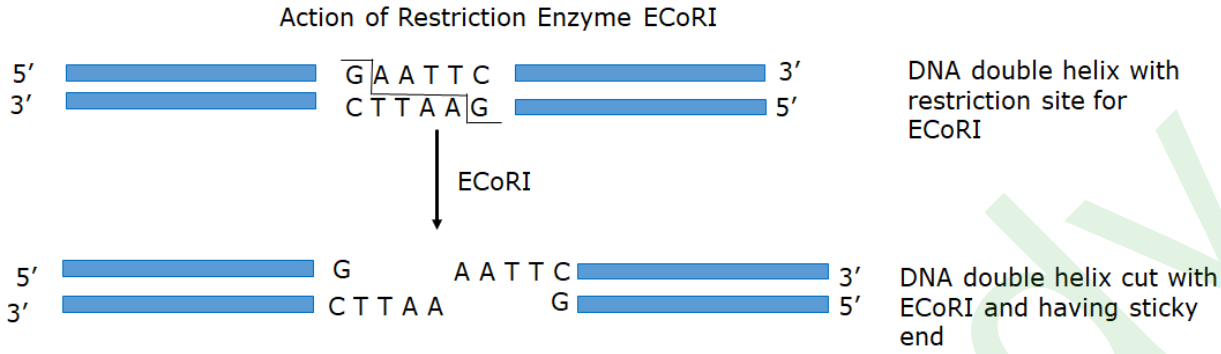
1. In starch containing solution, such as potato processing plants
2. In sewage and animal manure medium

7) How does EcoRI specifically act on DNA molecule? Explain.

[2]

Answer:

ECoRI recognises the restriction site GAATTC and cut the DNA double helix between bases G and A giving rise to sticky ends.



8) (a) Explain the cause responsible in a human to have se chromosomes as 'XXY' instead of 'XX' or 'XY'.

(b) List any two ways such individuals are different from the normal being.

[2]

Answer:

a) It is caused due to a genetic disorder Klinefelter's syndrome in which an additional copy of 'X' chromosome is created which results in karyotype XXY.

b) Such individuals are different from a normal human being in the following aspects:

i. They have an overall masculine body but possess female characteristics (such as the development of breast)

ii. They are sterile and unable to reproduce.

9) Name and explain the technique that can be used in developing improved crop varieties in plants bearing female flowers only.

[2]

Answer:

Bagging method is used in developing improved crop varieties in plants bearing females flowers only.

In the bagging method, the buds of female flowers are bagged before opening. When the stigma matures and becomes receptive, the stigma is dusted with desired pollens and flower is re-bagged again.

OR

9) When are the non-flowering plants said to be homothallic and monoecious; and heterothallic and dioecious? Give an example of each.

[2]

Answer:

When both male and female reproductive parts are present on the same plant, the non-flowering plants are called homothallic and monoecious.

When both male and female reproductive parts are present on the different plants, the non-flowering plants are called heterothallic or dioecious.

10) Mention the kind of interaction mycorrhizae exhibit. How is *Glomus* in mycorrhizal association beneficial to the plants?

[2]

Answer:

Mycorrhizae exhibit symbiotic interaction in which both the organisms (fungi and roots of higher plants) are benefitted.

Glomus absorbs phosphorus from the soil and passes it to the plant. It also helps in providing resistance against root bore pathogens, tolerance to pathogens, salinity and drought. It also helps in overall growth of plants.

11) Given below is the segment of a DNA strand. Write its complementary strand and the RNA strand that can be transcribed from the DNA molecule formed.

5' TAC CGT GAC GTC 3'

[2]

Answer:

5’ TAC CGT GAC GTC 3’

3’ ATG GCA CTG CAG 5’ (Complementary Strand)

↓ (Transcription)

5’ UAC CGU GAC GUC 3’ (RNA Strand)

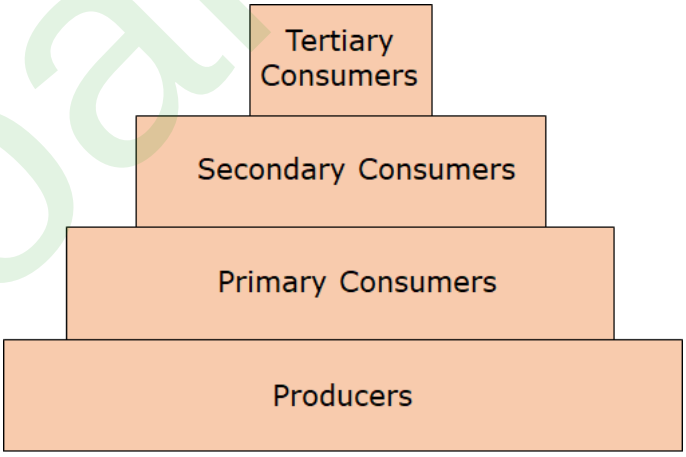
12) Name the type of Ecological Pyramid that can exist as upright as well as inverted. Explain how does it happen.

[2]

Answer:

The ecological pyramid that can exist as upright as well as inverted is pyramid of biomass.

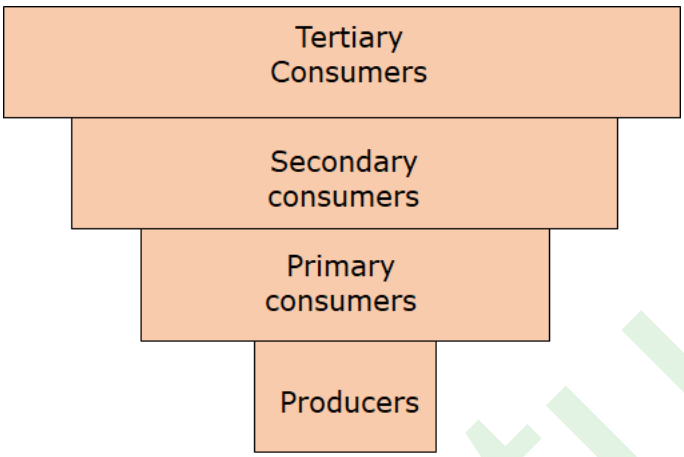
In grassland ecosystem, the number or the biomass of the producers is more as compared to consumers of successive higher levels.



Grassland Ecosystem

In sea ecosystem, the number or the biomass of the producers is less as compared to the consumers of

successive higher levels resulting in an inverted pyramid. The pyramid of biomass in sea is usually inverted because the biomass of fishes far exceeds that of phytoplankton.



Sea Ecosystem

SECTION C

13) "Cotton bollworms enjoy feeding on cotton plants, but get killed when feed on Bt cotton plant." Justify the statement.

[3]

Answer:

Bt cotton is the genetically modified plant created by genetically altering the cotton genome to express a microbial protein from the bacterium *Bacillus thuringiensis*. It produces the toxin crystals that normal cotton plant would not produce. The toxin is coded by a gene *cryIAc* (*cry*). Upon ingestion by a specific population of the organisms, it dissolves the gut lining and leads to

the death of the organism. For example, the proteins encoded by the genes *cryIAc* and *cryIIAb* present in Bt cotton plant kills the cotton bollworms.

OR

13) (a) Mention the cause of ADA deficiency in humans.

(b) How is gene therapy carried out to treat the patients suffering from this disease?

(c) State the possibility of a permanent cure of this disease.

[3]

Answer:

(a) In humans, ADA deficiency is caused due to the deletion of the gene for enzyme adenosine deaminase.

(b) ADA deficiency can be treated by gene therapy. In this method, lymphocytes from the blood of the patient are grown in a culture outside the body. Then, by using a retroviral vector, a functional ADA cDNA is introduced into these lymphocytes, which are successively returned to the patient's body.

(c) ADA deficiency can be cured permanently, if the adenosine deaminase producing isolated genes

from the marrow cells are introduced into the cells at early embryonic stages.

14) (a) Differentiate between intrauterine insemination and intrauterine transfer.

(b) Mention one positive and one negative application of amniocentesis.

[3]

Answer:

(a)

Intrauterine Insemination	Intrauterine Transfer
In this process, sperms are placed inside the uterus of a woman to ease the fertilisation.	In this process, embryos are placed into the uterus of a woman to establish the pregnancy.

(b) Positive application of amniocentesis - It is used to test the presence of certain genetic disorders, like haemophilia, and also to determine the survivability of the foetus.
Negative application of amniocentesis - It is used for the sex-determination which results in an increased threat of female foeticides.

15) Explain the solutions found by Ahmed Khan, a Bengaluru based plastic sack manufacturer,

after realising the problems created by plastic wastes.

[3]

Answer:

Ahmed Khan, a plastic sack manufacturer in Bangalore, has been producing plastic sacks for 20 years. He realized that plastic waste was a huge problem and should be recycled. His company developed polyblend, a fine powder of recycled modified plastic. It is used to lay the roads by mixing it with bitumen.

In collaboration with R. V. College of Engineering and the Bangalore City Corporation, he proved that mixture of polyblend and bitumen enhanced the water repellant properties of the bitumen and helped to increase the life of the road three times. In Bangalore, more than 40 kms of road has already been laid by the year 2002.

16) Mention the chemical nature of an antibody and name the type of cells they are produced by. Write the difference between active and passive immune responses on the basis of antibodies.

[3]

Answer:

Antibodies are globular plasma proteins produced by B cells of the immune system.

The difference between active and passive responses is that the active response or immunity is developed due to the production of antibodies inside the body, whereas passive immunity is developed when the antibodies are provided from outside.

OR

16) Name the cells that act as HIV factory in humans when infected by HIV. Explain the events that occur in these infected cells.

[3]

Answer:

Macrophages act as HIV factory in the human body when infected by HIV.

After entering into the body of a person, the virus enters into macrophages, where the RNA genome of the virus replicates to form viral DNA with the help of the enzyme reverse transcriptase. This viral DNA is then incorporated into the DNA of the host cell and it directs the infected cells to produce virus particles. Thus macrophages continue to produce virus.

17) (a) Why is the collection of white winged moths and dark winged moths made in England between 1850 – 1920 considered a good example of natural selection?

(b) "Evolution is based on chance events in nature and chance mutations in organisms." Justify the statement.

[3]

Answer:

(a) In a collection of moths made in 1850s in England, it was observed that there were more white-winged moths on trees than dark-winged. However, in the collection carried out from the same area after industrialisation, i.e., in 1920, there were more dark-winged moths in the same area, i.e., the proportion was reversed. It is because during post-industrialisation period, the tree trunks became dark due to industrial smoke and soot. Under this condition, the white-winged moth did not survive due to their easy visibility to predators, but the dark-winged moth survived. This showed that in a mixed population, those that can better-adapt, survive and increase their population size. Hence, this is a good example of natural selection.

(b) Evolution is not a predictable directed process in sense of determinism. It is rather based on chance events and mutations occurring in nature and organisms respectively. For example, excessive use of pesticides and antibiotics may lead to appearance of resistant organisms in a span of

months and years but not centuries. This shows that evolution is not a directed process, it is a stochastic process based on chance events in nature and chance mutation in organisms.

18) (a) Compare the mechanism of sex determination in humans with that of honey bees, with respect to chromosome number.

(b) How is the gamete formation comparable in the above two cases?

[3]

Answer:

(a) In honey bee, the mechanism of sex determination is of the XO type in which females have a pair of X-chromosomes besides autosomes, whereas the males have a single X-chromosome.
On the other hand, in humans, XY type of sex determination is seen where both male and female have same number of chromosomes. Males bear autosomes plus XY, while female have autosomes plus XX.

(b) In both the cases two different types of gametes are produced by the males. In honey bees, the gametes produced by males will be either with or without X chromosome. However, in humans, the

gametes produced by males will have either X chromosome or Y chromosome.

19) Differentiate between the pattern of inheritance in humans of the blood diseases, haemophilia and thalassemia.

[3]

Answer:

Haemophilia	Thalassemia
It is a genetic disorder in which blood clotting ability get impaired due to the defect in one of the blood clotting factors. It leads to spontaneous bleeding on injury.	It is a type of an inherited autosomal recessive disorder in which abnormal haemoglobin is synthesised that decreases the oxygen carrying capacity of blood. As a result, devastation of blood cells takes place that causes anaemia.
It is an X- linked recessive disorder and is more common in males than in females.	There are two types of thalassemia, i.e., alpha thalassemia (production of α-globin chain affected) and beta thalassemia (β-globin chain affected).

Males can inherit this disease from heterozygous carrier mother and such males become infertile.	If both the parents are carriers of this disease, the individual has 25% chance of inheriting the disease.

20) Identify i, ii, iii, iv, v and vi in the following table:

No.	Organism	Bioactive molecules	Use
1	***Monascus purpureus***	i	ii
2	iii	iv	Antibiotic
3	v	Cyclosporin A	vi

[3]

Answer:

No.	Organism	Bioactive molecules	Use
1	***Monascus purpureus***	**i.** Cyclosporin A	**ii**. Blood-cholesterol lowering agent
2	**iii**. *Streptococcus*	**iv**. Streptokinase	**Antibiotic**
3	**v**. *Trichoderma polysporum*	**Cyclosporin A**	**vi**. Immunosuppressive agent in organ transplant

21) (a) Write the scientific name of methanogen bacteria. Where are these bacteria

generally found? Explain their role in biogas production.

(b) Name the components of biogas.

[3]

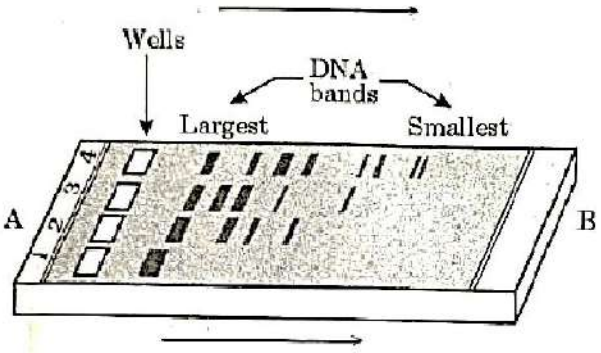
(a) The scientific name of methanogen bacteria are *Methanobacterium.* These bacteria are generally found in the anaerobic sludge and also in the rumen of cattle. These bacteria anaerobically break down the organic waste and produce methane containing biogas as an energy product.

(b) The components of biogas are:

i. Methane (CH_4)
ii. Carbon dioxide (CO_2) and
iii. Small amount of hygrogen sulphide (H_2S) and hydrogen (H_2)

Section D

22) Given below is the diagram representing the observations made for separating DNA fragments by Gel electrophoresis technique. Observe the illustration and answer the questions that follow.



(a) Why are the DNA fragments seen to be moving in the direction A→B?

(b) Write the medium used on which DNA fragments separate.

(c) Mention how the separated DNA fragments can be visualised for further technical use.

[3]

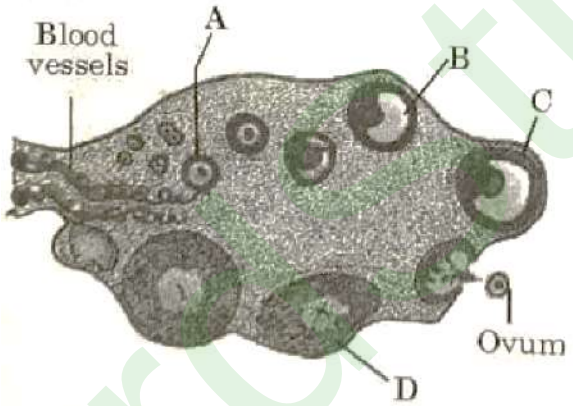
Answer:

(a) In the process of gel electrophoresis, as the gel runs, the smallest pieces of DNA move towards the positive end of the gel, while the largest pieces of DNA remain near the wells. In the given illustration, B is the positive end of the gel. DNA fragments, being negatively charged, move towards the positive end. Thus, DNA fragments are moving in the direction A to B.

(b) In the process of gel electrophoresis, agarose gel is used as the medium on which DNA fragments separate.

(c) The separated DNA fragments are stained with a dye called ethidium bromide (EtBr). After staining, DNA fragments can be visualised under the UV radiation, as ethidium bromide shows fluorescence under the UV light.

23) Study the transverse section of human ovary given below and answer the questions that follow.



(a) Name the hormone that helps in the growth of A→B→C.

(b) Name the hormone secreted by A and B.

(c) State the role of the hormone produced by D.

[3]

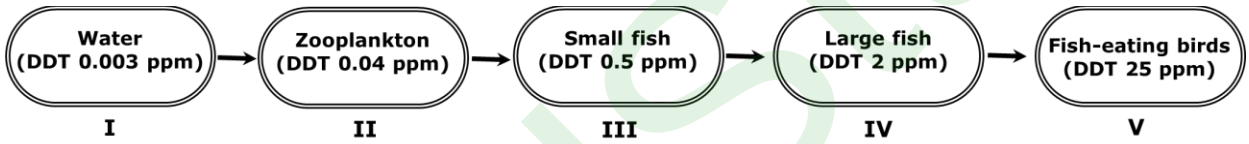
Answer:

(a) Follicle stimulating hormone (FSH) helps in the growth of A → B → C.

(b) Estrogen is secreted by A and B.

(c) Progesterone is secreted by "D" i.e. corpus luteum. It maintains the endometrium of the uterus.

24) Indiscriminate use of chemicals, pesticides and weedicides by humans are polluting our water bodies, which in turn are harming the living organisms. Study the flow chart and answer the questions based on it.



(a) Why does the concentration of DDT seem to be considerably high in the top consumer?

(b) How would the organisms at the highest level be affected?

(c) Name the phenomenon observed.

[3]

Answer:

(a) DDT is a toxic substance which cannot be excreted or metabolised by an organism. Therefore, it gets accumulated in the body of the organism and can be passed on to the next trophic level.

This phenomenon in which the concentration of a toxicant increases at successive trophic levels is called biomagnification.
Thus, in the given flow chart, the concentration of DDT seems to be considerably high in the top consumer due to biomagnification.

(b) The presence of DDT in high concentrations in birds causes a disturbance in the metabolism of calcium. This results in eggshell thinning and premature egg breaking. Eventually, bird populations may decline.

(c) Biomagnification

SECTION E

25) (a) According to ecologists, tropical regions in the world account for greater biological diversity. Justify.

(b) Why are habitat loss and alien species invasion considered as the causes of biodiversity loss? Explain with the help of an example of each.

[5]

Answer:

(a) According to ecologists, biological diversity is greater in tropical reasons due to the following reasons:

1. In the past, temperate regions were subjected to frequent climatic changes such as glaciations. However, tropical regions have remained relatively undisturbed for millions of years. This constant environment allowed species to diversify over millions of years without any environmental disturbances.
2. Tropical regions are less seasonal, relatively more constant and predictable in terms of the environment. This helps in greater species diversification over time.
3. Tropical regions receive more solar energy throughout the year. This significantly contributes to higher productivity and thus, greater diversity.

(b) The large varieties of plant and animal species that constitute our biosphere are dwindling at an alarming rate. This is largely due to human activities and interventions with natural phenomenon. The reasons for considering habitat loss and alien species as the cause of biodiversity loss are enlisted below:

1. Habitat loss: Human activities have been largely responsible for the loss of existing habitats resulting in a very sharp decline in biodiversity. For example, the Amazon rain forest, which harbours a large variety of species across the globe, is being cut at a very rapid pace to cultivate *soya beans* or for

conversion into grassland for raising cattle for beef production.

2. Alien species invasion: When an alien species is introduced in an ecosystem intentionally or unintentionally, at times, it turns invasive. This invasion results in the decline or extinction of indigenous species. For example, the introduction of Nile perch into Lake Victoria resulted in the extinction of over 200 species of cichlid fish in the lake.

OR

25) (a) What is an ecological succession?

(b) Differentiate between primary and secondary succession. Why is secondary succession faster that primary succession? Explain with suitable examples.

(c) What are pioneer species? Give examples of pioneer species in Xerarch and Hydrarch successions respectively.

[5]

Answer:

(a) Ecological succession refers to the gradual and fairly predictable changes in the composition of species of a certain area. During ecological succession, some species colonise a particular area and their population increases while the population of other species decreases or they

disappear. It is of two types, namely, primary succession and secondary succession.

(b) Primary succession occurs in areas like bare rock, lava, and newly created reservoir or pond. These areas lack soil. The formation of fertile soil in these areas takes place over a span of several hundred to thousand years. However, secondary succession occurs in the areas that were once inhabited by biological communities. These areas include abandoned farmlands, cut or burned forests, and lands that have been flooded. The fertile soil is present in these areas. Thus, no time is invested in soil formation so, secondary succession is faster than primary succession.

The differences between primary and secondary succession are tabulated below:

Primary succession	**Secondary succession**
It occurs in the areas where no living organisms ever existed.	It occurs in the areas where natural biotic communities have been destroyed due to natural disturbances.
Initially, the soil is absent during primary succession.	Some soil or sediment is present.
It is a slow process.	It is faster than primary succession.

(c) The species that invade a bare area are known as pioneer species. Its common example is Lichen.

Later, these species help in the growth of very small plants, which are ultimately succeeded by bigger plants.
Succession of plants in dry areas is called Xerarch succession while in wetter areas is called Hydrarch succession. The examples of pioneer species in Xerarch and Hydrarch succession are lichen and phytoplankton, respectively.

26) (a) Name the type of DNA that forms the basis of DNA fingerprinting and mention two features of this DNA.

(b) Write the steps carried out in the process of DNA fingerprinting technique, and mention its application.

[5]

Answer:

(a) DNA fingerprinting is a quick way to compare the DNA sequences of any two individuals. **Satellite DNA** forms the basis of DNA fingerprinting. The main features of this DNA are:

1. It forms a large portion of the human genome but does not code for any proteins.
2. It shows a high degree of polymorphism and is an important tool in forensic applications.

(b) Steps carried out in the process of DNA fingerprinting are as follows:

1. Isolation of DNA.

2. Digestion of DNA with the help of restriction endonucleases.
3. Separation of DNA fragments by the process of electrophoresis.
4. Transferring of separated DNA fragments to synthetic membranes like nylon or nitrocellulose.
5. Hybridisation using labelled satellite DNA (also called VNTR) probe.
6. Detection of hybridised fragments by autoradiography.

Applications of DNA fingerprinting are:

1. In paternity issues since polymorphisms are inherited from parents to children.
2. In forensic crime analysis (using blood, hair-follicle, skin, saliva, semen, etc.).
3. In population genetics to analyse variation within the population.
4. In conservation biology to study the genetic variability of endangered species.
5. In evolutionary biology to compare DNA extracted from fossils to present-day animals or humans.

OR

26) Explain the role of different genes in a *lac* operon, when in a 'Switched On' state.

[5]

Answer:

In bacteria and humans, *lac* operon (lactose operon) is required for lactose transport and metabolism. In *lac* operon, regulatory genes and a common promoter regulate a polycistronic structural gene.

The genes present in a lac operon are:

1. Regulatory gene (the *i* gene) – It synthesises the repressor of the operon.
2. Structural genes:
   - **a.** *z* gene – It synthesises beta-galactosidase which helps in the hydrolysis of lactose into glucose and galactose.
   - **b.** *y* gene – It codes for permease, which makes the cell permeable to beta-galactosidase.
   - **c.** *a* gene – It helps in the synthesis of transacetylase.

The operon is switched on in the presence of lactose. Lactose acts as an inducer. It binds to the repressor (encoded by *i* gene), allowing RNA polymerase to bind to the promoter. This initiates transcription and the products of structural genes (beta-galactosidase, permease and transacetylase) are synthesised.

27) (a) Draw a diagram of a fully developed embryo sac of an angiosperm. Label its chalazal end and any other five parts within the embryo sac.

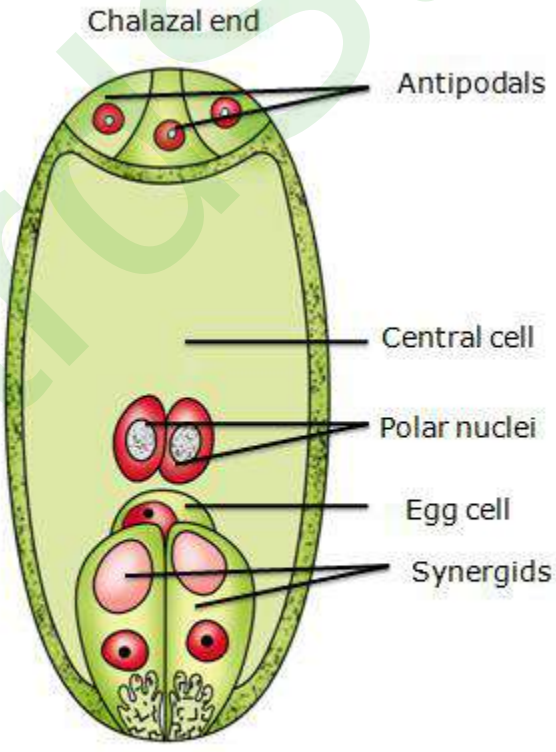
(b) Why does the development of an endosperm precede that of the embryo in angiosperm?

(c) Number of chromosomes in an onion plant cell is 16. Name the cells of the embryo sac having 16 and 24 chromosomes formed after fertilisation.

[5]

Answer:

(a)



Fully Developed Embryo Sac

(b) In angiosperms, the development of an endosperm precedes embryo development. This is because the developing embryo requires nutrition for its growth and development. This nutrition is provided by the endosperm.

(c) Number of chromosomes in an onion plant cell (2n) is 16. This implies that the number of chromosomes in the gametes (n) is 8.

Zygote is formed by the fusion of a male gamete and an egg cell, so it will have 2n number of chromosomes.
2n = 2 x 8 = 16
An endosperm is formed by triple fusion, that is, the fusion of a male gamete and polar nuclei. Therefore, an endosperm has 3n number of chromosomes.
3n = 3 x 8 = 24
Thus after fertilization, the zygote and endosperm will have 16 and 24 chromosomes, respectively.

OR

27) Describe the events that occur after fertilisation of an ovum till implantation in a human female.

[5]

Fertilisation refers to the process of fusion of an ovum and a sperm. Fertilisation of the ovum results in the formation of a diploid zygote.

1. The zygote undergoes various mitotic divisions while moving towards the uterus through the isthmus of the oviduct.
2. These divisions results in the formation of 2, 4, 8 and 16 daughter cells. These are known as blastomeres.
3. The embryo having 8 to 16 blastomeres is referred to as morula. As morula moves further into the uterus, it undergoes continuous division and gets transformed into blastocyst.
4. In the blastocyst, blastomeres are arranged in the following way:
    a. They form an outer layer, which is called trophoblast.
    b. An inner cell mass gets attached to the trophoblast.
5. The blastocyst gets attached to the endometrium of the uterus through the trophoblast layer and the inner cell mass gets differentiated as the embryo.
6. Once the blastocyst is attached, the cells of the uterus divide rapidly to cover the blastocyst. This embedding of the blastocyst in the endometrium is called implantation.

Biology Delhi (Set 2)

General Instructions:

Read the following instructions very carefully and strictly follow them:
(i) Question paper comprises **five** sections – A, B, C, D and E.
(ii) There are **27** questions in the question paper. **All** questions are compulsory.
(iii) Section **A** question number **1** to **5** are multiple choice questions, carrying **one** mark each.
(iv) Section **B** question number **6** to **12** are short answer questions type-I, carrying **two** marks each.
(v) Section **C** question number **13** to **21** are short answer questions type-II, carrying **three** marks each.
(vi) Section **D** question number **22** to **24** are short answer questions type-III, carrying **three** marks each.
(vii) Section **E** question number **25** to **27** are long answer questions, carrying **five** marks each.
(viii) Answer should be brief and to the point also the above word limit be adhered to as far as possible.
(ix) There is no overall choice in the question paper. However, an internal choice has been provided in two questions of **1** mark, one question of **2** marks, two questions of **3** marks and three questions of **5** marks questions. Only **one** of the choices in such questions have to be attempted.
(x) The diagram drawn should be neat proportionate and properly labelled, wherever necessary.
(xi) In addition to this, separate instructions are given with each section and question, wherever necessary.

Question 1

In a bacterium when RNA-polymerase binds to the promoter on a transcription unit during transcription, it
(a) terminates the process
(b) helps remove introns
(c) initiates the process
(d) inactivates the exons

Solution:

RNA polymerase is the key enzyme for the process of transcription. This enzyme recognizes the promoter region and initiates the transcription process. This leads to the

formation of RNA (or mRNA) from the template DNA.

Hence, the correct answer is option C.

Question 2

The first cellular form of life evolved
(a) in air
(b) on land
(c) in water environment
(d) in deep soil

Solution:

The first cellular forms of life evolved in water.

Hence, the correct answer is option C.

Question 3

Mating of a superior male of a breed of a cattle to a superior female of another breed is called
(a) in breeding
(b) out crossing
(c) out breeding
(d) cross breeding

OR

Large-holes in 'Swiss-Cheese' are due to
(a) *Propionibacterium sharmanii*
(b) *Saccharomyces cerevisae*
(c) *Penicillium chrysogenum*
(d) *Acetobacter aceti*

Solution:

Mating of superior male of one breed and superior female of another breed to obtain the desirable qualities of two breeds can be combined by the process of cross breeding. e.g., Hisardale is a new breed of sheep developed in Punjab by crossing Bikaneri ewes and Marino rams.

Hence, the correct answer is option D.

OR

The large holes in 'Swiss cheese' are due to the production of a large amount of CO_2 by a bacterium called *Propionibacterium sharmanii*.

Hence, the correct answer is option A.

Question 4

Increased concentration of DDT in fish-eating birds is due to
(a) eutrophication
(b) bio-magnification
(c) cultural eutrophication
(d) accelerated eutrophication

OR

Species-Area relationship is represented on a log scale as
(a) hyperbola
(b) rectangular hyperbola
(c) linear
(d) inverted

Solution:

Biomagnification is the increase in the concentration of non biodegradable material at each trophic level of the food chain. e.g., Biomagnification of DDT in the food chain.

Hence, the correct answer is option B.

OR

The species-area relationship, when represented on a logarithmic scale, shows a typical linear curve.

Hence, the correct answer is option C.

Question 5

Which one of the following part of the plant when put into the soil is likely to produce new offspring?
(a) Part of an internode
(b) A stem cutting with a node
(c) Part of a primary root
(d) A flower

Solution:

The new plantlet grows from the nodes present in the stem of the flowering plants.

Hence, the correct answer is option B.

Question 6

Name the Scientists and write how did they explain Mendel's laws after the chromosomes were discovered.

Solution:

Sutton and Boveri came up with the Chromosomal Theory of Inheritence. According to this theory Mendel's factors or genes are located on the chromosomes only. Following observations led Sutton and Boveri to come up with Chromosomal Theory of Inheritence:

1) Chromosomes occur in pairs just like Mendelian factors or genes with a diploid cell.
2) Chromosomes segregate like Mendelian factors during the process of gametogenesis.
3) Only one chromosome of a pair is observed in a gamete just like mendelian factor.
4) The paired condition of chromosomes and Mendelian factors is restored after fertilization.

Based on the above mentioned observations, Sutton and Boveri proposed that the location of the Mendelian factors or genes is on chromosomes indeed.

Question 7

State two advantages of an apomictic seed to a farmer.

Solution:

Apomictic seeds are advantageous over the hybrid seeds in the following ways:

(i) They reduce the cost of hybrid breeding programmes.

(ii) Desired traits can be maintained without losing superiority of hybrids over parents (hybrid vigour), and farmers can replant these seeds year after year.

Question 8

List two diseases that spread through inhaling droplets or aerosols. Write one prominent symptoms for each one of them.

Solution:

The two diseases that spread through inhaling droplets or aerosols are diphtheria and common cold.

The prominent symptoms of these diseases are:

Diphtheria- sore throat and swollen lymph nodes.
Common Cold- nasal congestion and sneezing.

Question 9

What makes humus a reservoir of nutrients? Name and write about the process humus undergoes that enriches the soil.

Solution:

Humus is a reservoir of nutrients as it is derived from litter or organic matter scattered over soil surface such as leaves, twigs, dead bodies of organisms and their excretion. It is an amorphous, dark coloured substance, resistance to microbial action and undergoes decomposition at a very slow rate. Being colloidal in nature it acts as a good source of inorganic nutrients, which are often returned back to the soil during decomposition of humus by the process of mineralization.

Question 10

(a) Name the two techniques employed to meet the increasing demand of fish in the world.
(b) Name any two fresh water fishes.

OR

Describe the contributions of Alexander Fleming, Ernest Chain and Howard Florey in the field of microbiology.

Solution:

a) The two techniques employed to meet the increasing demand of fish in the world are:

• Pisciculture- It is the rearing of fish for food in enclosures such as fish ponds or tanks.

• Inland Fisheries- Inland fisheries are the commercial fishing operations that takes place in freshwater. It includes capture fishery, where the fish living naturally in a body of water are harvested. The other type of inland fishery is the fish farm, where fish are raised in tanks or ponds, generally for human consumption.

b) Rohu, Common Carp

OR

Alexander Fleming while working on *Staphylococci* bacteria, once observed a mould growing in one of his unwashed culture plates around which *Staphylococci* could not grow. He found out that it was due to a chemical produced by the mould and he named it Penicillin after the mould *Penicillium notatum*.

However, its full potential as an effective antibiotic was established much later by Ernest Chain and Howard Florey. This antibiotic was extensively used to treat American soldiers wounded in World War II. Fleming, Chain, and Florey were awarded the Nobel Prize in 1945, for this discovery.

Question 11

All cloning vectors do have a 'selectable marker'. Describe its role in recombinant DNA-technology.

Solution:

The role of selectable marker is to identify and distinguish the bacterial cells that have taken up the recombinant vector during the transformation process.

Question 12

Mention how have plants developed mechanical and chemical defence against herbivores to protect themselves with the help of one example of each.

Solution:

The plants exhibit mechanical and chemical defence to protect themselves against herbivores. These have been enlisted as follows:

The chemical defence includes certain secondary metabolites produced by the plants. They do not participate in the metabolism of the plant and act by impeding certain biochemical pathways in herbivores. Example: alkaloids present in plants produce noxious smell and taste to keep the herbivores away.

Structures such as thorns and spines constitute the mechanical defence of the plant. These structures are the modifications of various plant parts, like thorn-modified branches and spines-modified leaves. They cause physical damage to the herbivores such as rashes and cuts.

Question 13

Explain 'Integrated organic' farming as successfully practiced by Ramesh C. Dagar, a farmer in Sonepat (Haryana).

Solution:

"Integrated Organic farming" is an agricultural technique that relies on crop rotation, green manure, biological pest control and compost. In this kind of farming, the waste from one process is utilised in another process, and hence it is zero waste process. It limits the use of synthetic fertilizers and pesticides.

Ramesh Chander Dagar, an organic farmer, followed integrated organic farming and has been proven to be successful. It comprises of many practices like bee keeping, dairy management, water harvesting, composting and agriculture, which support each other

and allow economic, sustainable and environment friendly venture. Cow dung is used a manure, and the plant wastes are used as compost in this practice.

Question 14

Explain three different modes of pollination that can occur in chasmogamous flower.

OR

Explain the formation of placenta after implantation in a human female.

Solution:

(i) **Autogamy** – It is the transfer of pollen grains from the anther to the stigma of the same flower. Autogamy requires the anther and the stigma to lie close. It also requires synchrony in the pollen release and stigma receptivity. Plants like Viola, Oxalis, etc. produce two kinds of flowers—chasmogamous (with an exposed anther and stigma) and cleistogamous (which do not open at all, only autogamy occurs).

(ii) **Geitonogamy** – It is the transfer of pollen from the anther of one flower to the stigma of another flower in the same plant. Genetically, it is similar to autogamy but requires pollinating agents.

(iii) **Xenogamy** – It is the transfer of pollen grains from the anther to the stigma of a different plant. Xenogamy causes genetically different types of pollens to be brought to a plant.

OR

The formation of placenta occurs after 12 weeks of pregnancy, when the finger like projection called chorionic villi appears on the trophoblast, penetrate the endometrium lining of uterine tissue.

This chorionic villi and uterine tissue interdigitate to form the structural and functional unit between developing embryo and maternal body called placenta, which help the embryo to obtain nutrients and oxygen and remove the metabolic waste and carbon dioxide.

Question 15

You are asked to find the genotypes of a tall pea plant growing in your school garden. Name the cross and explain how would you confirm the genotypes.

Solution:

The genotypes of a tall pea plant growing in our school garden can be found by test cross.

Test cross is a cross in which an individual with an unknown genotype is crossed with an individual (parent) homozygous recessive for that trait. This cross determines whether the dominant character is coming from homozygous dominant genotype or

heterozygous genotype. (e.g., tallness coming from TT or Tt)

Case I : When TT is crossed with tt, we obtain all Tt (tall) individuals in the progeny.

Case II : When Tt is crossed with tt, we obtain Tt (tall) and tt (dwarf) individuals in the progeny.

Therefore, if tallness is coming from TT, then we obtain all tall progenies in test cross. We obtain both tall and dwarf varieties in test cross, if tallness is coming from Tt.

Question 16

What are 'SNPs'? Where are they located in a human cell ? State' any two ways the discovery of SNPs can be of importance to humans.

Solution:

SNP refers to Single Nucleotide Polymorphism. It refers to the variation in the genome of organisms within a particular species because of changes in the sequence of a single nucleotide.

SNPs are located within the chromosomes in certain discrete locations. The discovery of SNPs can prove useful to humans in the following manner:
1. SNPs can be used to specifically identify genetic regions associated with certain genetic disorders.
2. SNPs can also be used in forensic sciences.

Question 17

What is adaptive radiation? Explain with the help of a suitable example.

Solution:

The process of evolution in which a particular trait or characteristic or a structure is modified over and over again as per the varied environment leading to divergent evolution is adaptive radiation.

Example : Australian Marsupials.

A number of organisms (marsupials) each different from the other (some land dwelling, some tree dwelling, etc.) evolved from the same ancestor but all within the Australian continent.

Question 18

(a) Explain the mode of action of Cu^{++} releasing IUDs as a good contraceptive. How is hormone releasing IUD different from it?
(b) Why is "Saheli' a preferred contraceptive by women (any two reasons)?

Solution:

(a) Cu^{++} releasing IUDs such as CuT exert their effects in two ways:
• They can trigger phagocytosis of sperms within the uterus.

• They can also affect the fertilizing ability of sperms and suppress their motility.

In contrast to Cu^{++} releasing IUDs, hormone-releasing IUDs alter the uterus through hormonal actions such that implantation does not occur.

(b) Saheli is a preferred contraceptive because of the following reasons:
1. Minimal side effects
2. High contraceptive value

Question 19

(a) Explain why bee-hives are setup on the farms for some of our crop-species. Name any two such crop species.
(b) List any three important steps to be kept in mind for successful bee keeping.

Solution:

(a) Beehives kept in crop fields during the flowering period, increase the pollination efficiency. This increases the yield of crop and honey.

Also, bees can easily collect huge amounts of nectar from the flowers of the crop in a close reach without much foraging. This increases honey production. This technique is practiced in apple and watermelon fields.

(b) Apiculture or bee keeping refers to the maintenance of hives of honeybees for the production of honey. For successful bee keeping, the following steps are necessary:

i. Accurate knowledge of nature and habit of bees
ii. Selection of a suitable location for maintaining beehives
iii. Management of beehives during different seasons

Question 20

Explain the role of *Agrobacterium tumifaciens* in developing resistance in tobacco plant against nematode *Meloidegyne incognitia*. Name the processes responsible for this.

Solution:

Agrobacterium tumifaciens is a normal pathogen of many dicot plants and is quite capable in transferring a piece of there own genome termed as T-DNA into the infected plant cells.

Thus, these bacterial cells with desired inserts within their T-DNA are the preferred medium for the transfer of foreign DNA inserts within the plant crop to create a desired GMO.

In case of tobacco plant the same method of *Agrobacterium* mediated transformation has been used to inactivate one of the house-keeping gene of the nematode pathogen *Meloidegyne incognitia*. The GMO crop of tobacco resistant to the pest infestation by this nematode is controlled by the very process of RNA interference or RNAi.

Here, the GMO tobacco crop carries a gene coding for sense and anti-sense RNA to the mRNA of one of the housekeeping genes of the nematode pest. The anti-sense RNA strand transcribed within the GMO tobacco crop effectively binds in a complementary fashion to the mRNA of the housekeeping gene of the nematode pest, effectively silencing it and leading to the death of the nematode.

Thus, RNAi is an effective strategy for control of this nematode infestation within the roots of the tobacco crop.

Question 21

Differentiate between “Pioneer-species”; “Climax-community” and “Seres”.

OR

Explain any three ways other than zoological parks, botanical gardens and wildlife safaries, by which threatened species of plants and animals are being conserved 'ex situ'.

Solution:

The differences between pioneer species, climax community and seres can be summarised as follows:

Pioneer species: A pioneer species is a species that is first to colonize a bare area. A typical example of pioneer species is lichen which firstly colonizes a bare rock during primary succession.

Climax community: A climax community is that community which arises during the final stages of succession and remain unchanged for a long period of time (as long as the

environment remains stable). A typical example includes a forest community.

Seres: Sere refers to the overall sequence of communities that arise during the course of ecological succession. Each community that exists during ecological succession is called a seral community.

OR

In addition to zoological parks, botanical garden and wildlife safaris, the following methods are being employed for the ex-situ conservation of plants and animals:

1. Seed banks: In this method, viable seeds from different plants are preserved in a temperature and moisture controlled environment. These seeds are then stored for extended periods of time.

2. Gene banks: This method is preferred for animals. In gene banks, embryos, sperms or eggs of endangered animals are stored in the low-temperature environments.

3. Cryopreservation: In this method, pollens, embryos or tissues can be preserved in liquid nitrogen at a temperature of -196°C.

Question 22

Following a road accident four injured persons were brought to a nearby clinic. The doctor immediately injected them with tetanus antitoxin.
(a) What is tetanus antitoxin ?
(b) Why were the injured immediately injected with this antitoxin?
(c) Name the kind of immunity this injection provided.

Solution:

(a) Tetanus antitoxin is solution of preformed antibodies.

(b) *Clostridium tetani*, a bacterium enters the body through cut & wounds and obstructs nerve signalling. This antitoxin neutralises the effect of tetanus toxin in the body. As the injured persons required immediate immunization in this case, so pre-formed antibodies(tetanus antitoxin) were delivered to the patients.

(c) Passive immunity would be provided in this case.

Question 23

"The population of a metro city experiences fluctuations in its population density over a period of time."
(a) When does the population in a metro city tend to increase?
(b) When does the population in metro city tend to decline?

(c) If 'N' is the population density at the time 't', write the population density at the time 't + 1'.

Solution:

(a) The population in a metro city will tend to increase when natality and immigration will be higher.

(b) The population in metro city will tend to decline when mortality and emigration will be higher.

(c) The equation $N_{t+1} = N_t + [(B + I) - (D + E)]$ represents the population density at time t + 1. The components of the equation are

• $\mathbf{N_{t+1}}$: Population density at time t + 1.

• $\mathbf{N_t}$: Population density at time t.

• **B**: This represents natality. Natality refers to the number of births during a given period in the population.

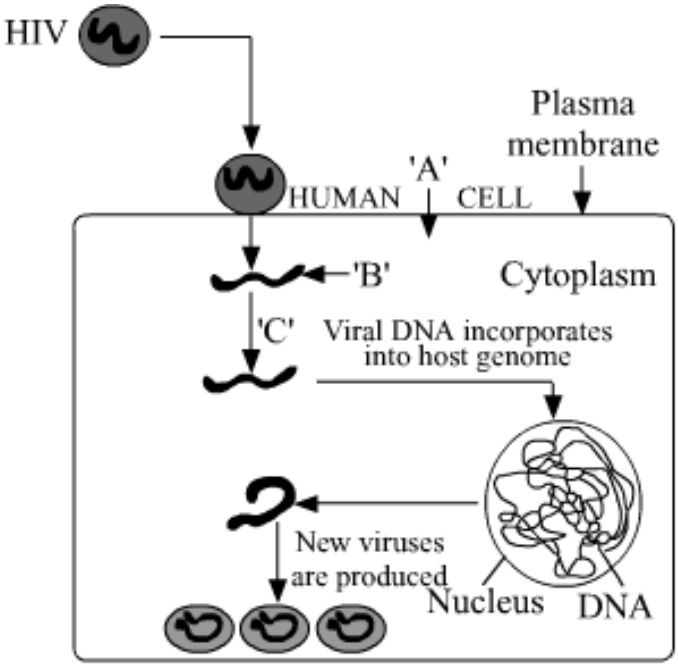
• **I**: It refers to immigration. It is the number of individuals of the same species that have come into habitat from elsewhere during the considered time period.

• **D :** This represents mortality. Mortality is the number of deaths in the population during a given period.

• **E**: It refers to emigration. It is the number of individuals of the population who left the habitat and went elsewhere during the considered time period.

Question 24

Study the diagram showing the entry of HIV into the human body and be processes that are followed :



(a) Name the human cell **'A'** HIV enters into.
(b) Mention the genetic material **'B'** HIV releases into the cell.
(c) Identify enzyme **'C'**.

Solution:

(a) HIV which is the causative agent of AIDS specifically attacks helper T-cells. So, 'A' is helper T-cells.

(b) Viral RNA is introduced into the cell. So, 'B' is RNA.

(c) Enzyme 'C' is reverse transcriptase.

Question 25

(a) Why did T.H. Morgon select Drosophila melanogaster for his experiments?
(b) How did he disprove Mendelian dihybrid F_2 phenotypic ratio of 9 : 3 : 3 : 1? Explain giving reasons.

OR

(a) List any four major goals of Human Genome project.
(b) Write any four ways the knowledge from HGP is of significance for humans.
(c) Expand BAC and mention its importance.

Solution:

a) T. H. Morgon selected *Drosophila melanogaster* as the model organism for his genetic studies because of the following reasons:

(i) *Drosophila* is easy and suitably grown on cheap synthetic medium under laboratory conditions in all seasons.

(ii) *Drosophila* has a short life cycle of two weeks only.

(iii) High number of progenies are generated per generation making it easy to observe variation.

(iv) Male and female flies can be easily distinguished from each other.

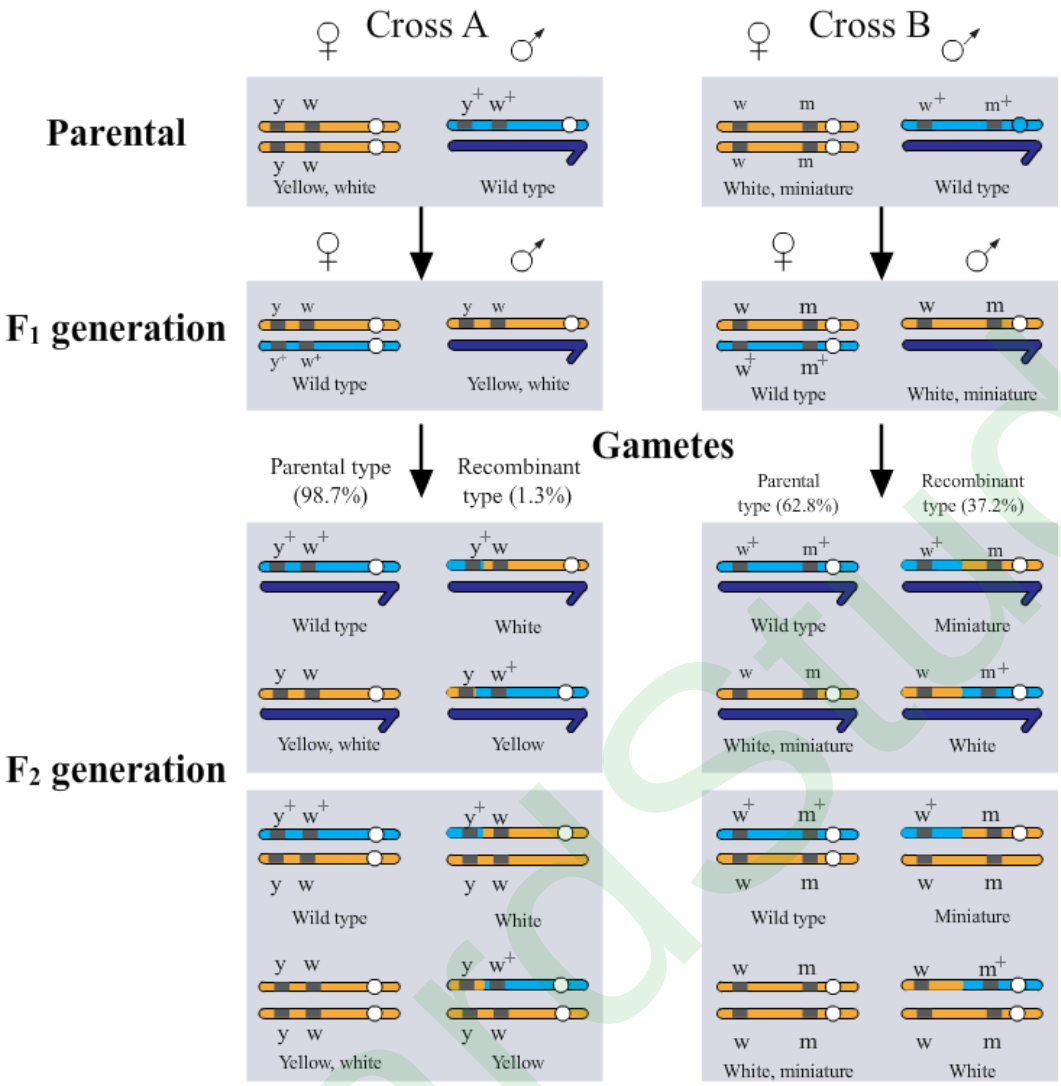
(v) Observable genetic variations can be easily noticed using a low power microscope or a hand lens.

(vi) Four pair of chromosomes in diploid organisms makes *Drosophila* a fairly simple model for genetic studies.

b) Morgan observed that for many genetic characters observed in case of *Drosophila*, the typical mendelian dihybrid cross ratio of 9:3:3:1 is not observed. This was proved by test cross of F_1 generation flies of dihybrid cross.

If the two genes involved in the dihybrid cross are assorting independently then the test cross of the F_1 generation individuals will result in off springs with 50% parental genetic combination and 50% recombinants, but that is not the case as observed by Morgan in case of *Drosophila*.

This can be demonstrated as follows:



OR

a) Main goals of Human genome project (HGP) are:

To identify all the genes (approximately 20,000-25,000) present in the human DNA.
To determine the accurate sequence of 3 billion chemical base pairs which make up the human genome

To store the above information in the form of databases.
To improve the tools available for data analysis

(b) The four important advantages of the Human genome project (HGP) are:

1. HGP has led to better understanding of Human Biology and Genetics in general.
2. HGP has paved the way for personalised medicine in future based on one's own

genome.

3. HGP has shed a lot of light on human evolution and phylogenetics.

4. HGP has provided greater insights into the field of genetic disorders and their cures.

c) BAC stands for Bacterial Artificial Chromosome. It is an artificially constructed vector containing the origin of replication & selectable marker for identification.

It is capable of carrying large DNA fragments and can replicate easily inside a bacterial cell.

These vectors are used in the human genome project for cloning large chunks of fragmented human genome with ease.

Question 26

(a) Name the insect that attacks cotton crops and causes lot of damage to the crop. How has Bt cotton plants overcome this problem and saved the crop ? Explain.
(b) Write the role of gene Cry IAb.

OR

(a) Explain the different steps carried out in Polymerase Chain Reaction, and the specific roles of the enzymes used.
(b) Mention application of PCR in the field of
(i) Biotechnology
(ii) Diagnostics

Solution:

a) Cotton Bollworm is a lepidopteran larvae which is notoriously known as the major pest of cotton balls. Bt cotton plants are GMOs containing the active Cry gene from *Bacillus thuringiensis* which leads to a production of inactive insecticidal protein, which becomes active and functional due to the alkaline pH in the gut of the lepidopteran larvae.

This happens when the pest larvae feeds on the GMO Bt crop, which produces the inactive toxin as produced by the *Bacillus thuringiensis*. The functional protein inside the larvae gut binds to the surface of midgut epithelial cells leading to formation of pores in them.

Due to this the midgut epithelial cells of the insect larvae swells up and lyse, leading to the death of the larvae itself. This way it leads to control of the major insect pest cotton bollworm.

b) CryIAb gene is responsible for the control of corn borer just like the way CryIAc controls the cotton bollworm.

OR

a) Polymerase Chain Reaction (PCR)- This process is used to amplify specific DNA into million or billion copies in vitro. It was invented in 1983 by Kary Mullis.

Two sets of primers (chemically synthesised oligonucleotide stretches that are complementary to a region of DNA), enzyme DNA polymerase,and deoxynucleotides are used in this process.

• PCR consists of 3 steps:

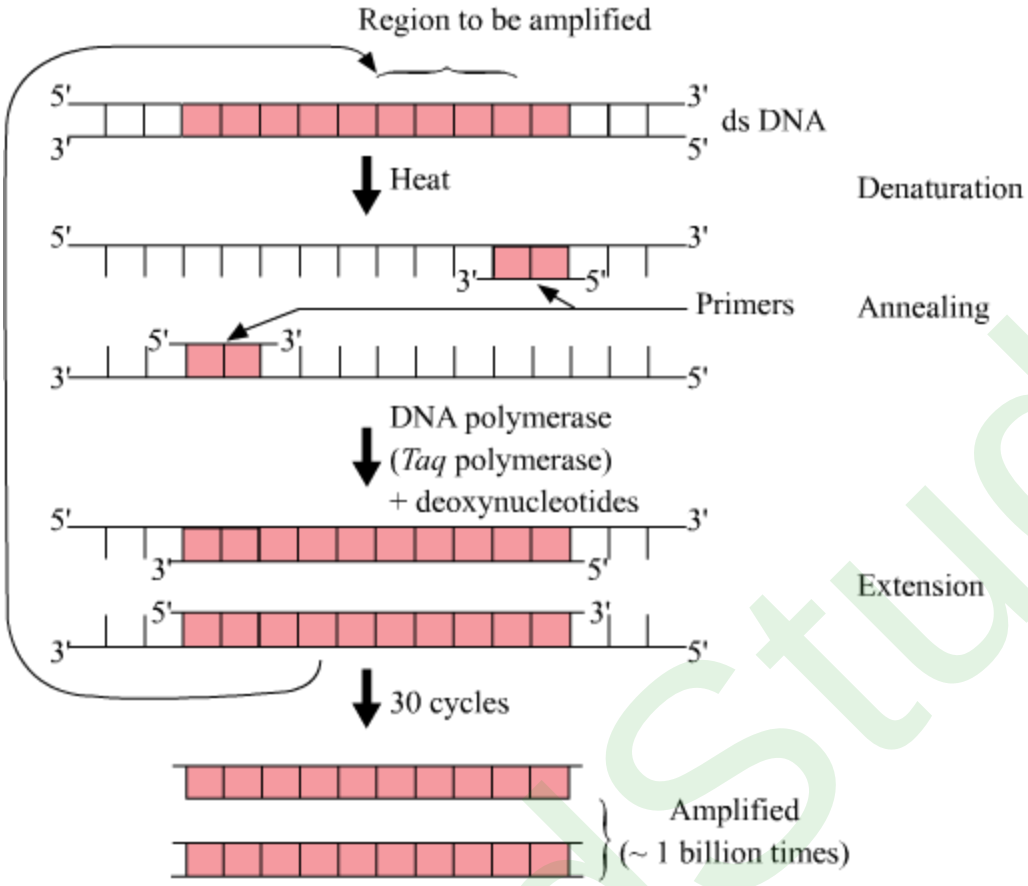
◦ Denaturation – Double helical DNA is denatured by providing high temperature. DNA polymerase does not get degraded in such high temperatures since the DNA polymerase used in this reaction is thermostable as it is isolated from thermophilic bacteria, Thermus aquaticus (Taq).

◦ Annealing- It is the step in which primers are annealed to single stranded DNA templates. Two sets of primers (small chemically synthesised oligonucleotides that are complementary to the regions of DNA) are used.

The temperature of reaction mixture is lowered to 50- 65°C for some seconds to allow annealing of primers. DNA polymerase extends the primer in 5' to 3' direction.

◦ Extension – Replication of DNA occurs in vitro.

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



The enzymes used in PCR is Taq polymerase which is obtained from the bacterium *Thermus aquaticus,* which yields DNA polymerase.

This enzyme is thermostable and can withstand the high temperature and is used in PCR in recombinant DNA technology.

b) i) In molecular biology to amplify a single or a few copies of a piece of DNA across several orders of magnitude, generating thousands to millions of copies of a particular DNA sequence.

ii) PCR is used in early diagnosis of bacteria and virus in body, when the concentration is extremely low, can be done by PCR since it amplifies the DNA several folds. It is used to detect HIV virus in suspected AIDS patients and mutations in genes in suspected cancer patients.

Question 27

(a) Explain the process of syngamy and triple fusion in angiosperms.
(b) Trace the development of the product of syngamy upto its mature stage in a dicot plant.
(c) Draw and label three important parts of a mature dicot embryo.

OR

Name the gonadotropins in human. Explain their role in human male and female, respectively.

Solution:

a) When one generative cell carried by the pollen tube fuses with the egg contained in the embryo sac of the ovule, this fusion of male and female gametes is called syngamy and its product is the zygote.

The other generative cell fuses with the two polar nuclei and this process is called triple fusion, where three nuclei are involved in the fusion process, one male gamete and two polar nuclei.

b) The product of syngamy is zygote which develops into embryo having two cotyledons in the following steps:

- The embryo develops at the micropylar end of the embryo sac where the zygote is situated.
- The zygote gives rise first to the pro-embryo, and then to the globular, heart-shaped, mature embryo.
- A typical dicot embryo consists of an embryonal axis and two cotyledons.
- The portion of the embryonal axis above the level of cotyledons is called epicotyl. It contains the plumule (shoot tip). The portion below the axis is called hypocotyl. It contains the radicle (root tip). The root tip is covered by the root cap.

OR

Gonadotropins are the hormones that act on gonads to increase the production of sex hormones. These are produced by anterior pituitary gland and act on testes and ovaries to stimulate the production of sperm or egg.

Luteinizing Hormone (LH) and Follicle Stimulating Hormone (FSH) are the main gonadotropins produced in humans.

They help in spermatogenesis and oogenesis as follows:

In Males,

LH : Act on the Leydig cells to secrete testosterone.
FSH : Stimulates the formation of sperms.

In Females,
FSH:

- Stimulates the growth of Graffian follicle
- Formation of secondary oocyte by helping in development of egg/oocyte within follicle to complete meiosis I.
- Stimulates the formation of estrogen.

LH :

- Helps in release of secondary oocyte by rupturing the mature Graffian follicle. Hence, causes ovulation.
- Takes part in development of corpus luteum.

Biology Delhi (Set 3)

General Instructions:

Read the following instructions very carefully and strictly follow them:
(i) Question paper comprises **five** sections – A, B, C, D and E.
(ii) There are **27** questions in the question paper. **All** questions are compulsory.
(iii) Section **A** question number **1** to **5** are multiple choice questions, carrying **one** mark each.
(iv) Section **B** question number **6** to **12** are short answer questions type-I, carrying **two** marks each.
(v) Section **C** question number **13** to **21** are short answer questions type-II, carrying **three** marks each.
(vi) Section **D** question number **22** to **24** are short answer questions type-III, carrying **three** marks each.
(vii) Section **E** question number **25** to **27** are long answer questions, carrying **five** marks each.
(viii) Answer should be brief and to the point also the above word limit be adhered to as far as possible.
(ix) There is no overall choice in the question paper. However, an internal choice has been provided in two questions of **1** mark, one question of **2** marks, two questions of **3** marks and three questions of **5** marks questions. Only **one** of the choices in such questions have to be attempted.
(x) The diagram drawn should be neat proportionate and properly labelled, wherever necessary.
(xi) In addition to this, separate instructions are given with each section and question, wherever necessary.

Question 1

Louis Pasteur demonstrated that
(a) early life came from outer space
(b) non-living chemicals produced living molecules
(c) life comes from pre-existing life
(d) life originated spontaneously

Solution:

Louis Pasteur disproved the theory of spontaneous generation by his famous swan-flask experiment and proved that even at microscopic level life originated from pre-existing life-forms only.

Hence, the correct answer is option C.

Question 2

Mating of a superior male of a breed of a cattle to a superior female of another breed is called
(a) in breeding
(b) out crossing
(c) out breeding
(d) cross breeding

OR

Large-holes in 'Swiss-Cheese' are due to
(a) *Propionibacterium sharmanii*
(b) *Saccharomyces cerevisae*
(c) *Penicillium chrysogenum*
(d) *Acetobacter aceti*

Solution:

Mating of superior male of one breed and superior female of another breed to obtain the desirable qualities of two breeds can be combined by the process of cross breeding. e.g., Hisardale is a new breed of sheep developed in Punjab by crossing Bikaneri ewes and Marino rams.

Hence, the correct answer is option D.

OR

The large holes in 'Swiss cheese' are due to the production of a large amount of CO_2 by a bacterium called *Propionibacterium sharmanii*.

Hence, the correct answer is option A.

Question 3

Increased concentration of DDT in fish-eating birds is due to
(a) eutrophication
(b) bio-magnification
(c) cultural eutrophication
(d) accelerated eutrophication

OR

Species-Area relationship is represented on a log scale as
(a) hyperbola
(b) rectangular hyperbola
(c) linear
(d) inverted

Solution:

Biomagnification is the increase in the concentration of non biodegradable material at each trophic level of the food chain. e.g., Biomagnification of DDT in the food chain.

Hence, the correct answer is option B.

OR

The species-area relationship, when represented on a logarithmic scale, shows a typical linear curve.

Hence, the correct answer is option C.

Question 4

Which one of the following part of the plant when put into the soil is likely to produce new offspring?
(a) Part of an internode
(b) A stem cutting with a node
(c) Part of a primary root
(d) A flower

Solution:

The new plantlet grows from the nodes present in the stem of the flowering plants.

Hence, the correct answer is option B.

Question 5

In a bacterium when RNA-polymerase binds to the promoter on a transcription unit during transcription, it
(a) terminates the process
(b) helps remove introns
(c) initiates the process
(d) inactivates the exons

Solution:

RNA polymerase is the key enzyme for the process of transcription. This enzyme recognizes the promoter region and initiates the transcription process. This leads to the formation of RNA (or mRNA) from the template DNA.

Hence, the correct answer is option C.

Question 6

Name one air-borne and a water borne disease in humans. List one specific symptom of each one of them.

Solution:

Airborne : Pulmonary Tuberculosis, Influenza
Symptoms of Tuberculosis : Pain and difficulty in breathing or coughing.

Waterborne : Diarrhoea, Typhoid
Symptoms of Diarrhoea : loose motions and watery stool.

Question 7

(a) Name the two techniques employed to meet the increasing demand of fish in the world.
(b) Name any two fresh water fishes.

OR

Describe the contributions of Alexander Fleming, Ernest Chain and Howard Florey in the field of microbiology.

Solution:

a) The two techniques employed to meet the increasing demand of fish in the world are:

• Pisciculture- It is the rearing of fish for food in enclosures such as fish ponds or tanks.

• Inland Fisheries- Inland fisheries are the commercial fishing operations that takes place in freshwater. It includes capture fishery, where the fish living naturally in a body of water are harvested. The other type of inland fishery is the fish farm, where fish are raised in tanks or ponds, generally for human consumption.

b) Rohu, Common Carp

OR

Alexander Fleming while working on *Staphylococci* bacteria, once observed a mould growing in one of his unwashed culture plates around which *Staphylococci* could not grow. He found out that it was due to a chemical produced by the mould and he named it Penicillin after the mould *Penicillium notatum*.

However, its full potential as an effective antibiotic was established much later by Ernest Chain and Howard Florey. This antibiotic was extensively used to treat American soldiers wounded in World War II. Fleming, Chain, and Florey were awarded the Nobel Prize in 1945, for this discovery.

Question 8

All cloning vectors do have a 'selectable marker'. Describe its role in recombinant DNA-technology.

Solution:

The role of selectable marker is to identify and distinguish the bacterial cells that have taken up the recombinant vector during the transformation process.

Question 9

Mention how have plants developed mechanical and chemical defence against herbivores to protect themselves with the help of one example of each.

Solution:

The plants exhibit mechanical and chemical defence to protect themselves against herbivores. These have been enlisted as follows:

The chemical defence includes certain secondary metabolites produced by the plants. They do not participate in the metabolism of the plant and act by impeding certain biochemical pathways in herbivores. Example: alkaloids present in plants produce noxious smell and taste to keep the herbivores away.

Structures such as thorns and spines constitute the mechanical defence of the plant. These structures are the modifications of various plant parts, like thorn-modified branches and spines-modified leaves. They cause physical damage to the herbivores such as rashes and cuts.

Question 10

How is humus formed? Mention any three characteristics of humus.

Solution:

Humus is formed as a result of action of decomposers and detrivores on the organic waste by the process of humification.

Three major charcteristics of humus are following:
(i) Amorphous
(ii) Dark Coloured
(iii) Colloidal and rich in inorganic minerals.

Question 11

State what are Mendelian disorders. Both thalassemia and colour blindness categorised as Mendelian disorders. Justify.

Solution:

The Mendelian disorder is a type of genetic disorder in humans which is characterized by mutation in a single gene. Their mode of inheritance follows the principles of Mendelian genetics. Mendelian disorders can be autosomal dominant (muscular dystrophy), autosomal recessive (sickle cell anaemia) or sex linked (haemophilia).

Thalassemia- Thalassemia is a recessive autosomal genetic defect that results in defect in the synthesis of globin polypeptide. The individuals whose one of the parents is a carrier may also becomes a carrier of the disease. If both the parents are carriers of the disease, the individual has 25% chance of inheriting the disease.

Colour Blindness- It is a sex-linked recessive trait in which the gene controlling a specific trait is present in its recessive form on the X-chromosome. It is a congenital disease (hereditary disease) in which the individual fails to distinguish red and green colours.

This gene appears in the normal (dominant) and the mutant (recessive) form. Because females have two X chromosomes while males have only one X chromosome, for a female to get affected by haemophilia she has to have the mutant gene on both the X chromosomes while males may be affected if they carry it on the X chromosome.

Question 12

State two advantages of an apomictic seed to a farmer.

Solution:

Apomictic seeds are advantageous over the hybrid seeds in the following ways:

(i) They reduce the cost of hybrid breeding programmes.

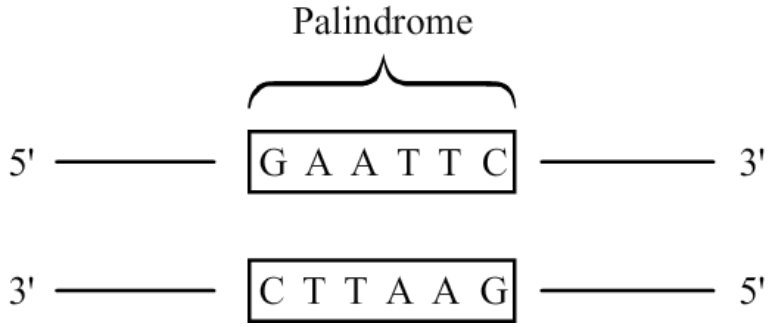
(ii) Desired traits can be maintained without losing superiority of hybrids over parents (hybrid vigour), and farmers can replant these seeds year after year.

Question 13

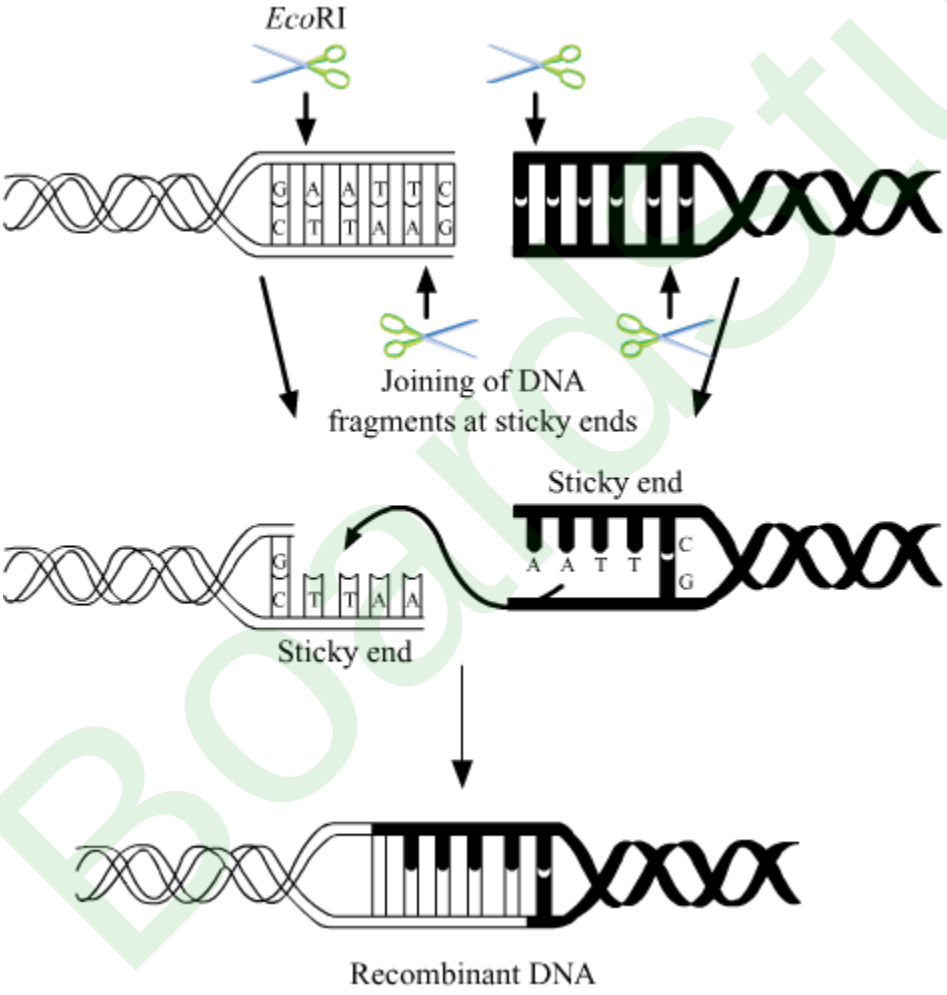
(a) Write the palindromic nucleotide sequence EcoRI recognises.
(b) Draw the vector DNA and a foreign DNA showing the sites where EcoRI has acted to form the sticky ends.
(c) Name the enzyme that helps in forming recombinant DNA.

Solution:

(a)



(b)



(c) There are many enzymes that help in forming recombinant DNA such as : Restriction enzymes, DNA ligases, DNA dependent DNA polymerase etc.

Question 14

Differentiate between “Pioneer-species”; “Climax-community” and “Seres”.

OR

Explain any three ways other than zoological parks, botanical gardens and wildlife safaries, by which threatened species of plants and animals are being conserved 'ex situ'.

Solution:

The differences between pioneer species, climax community and seres can be summarised as follows:

Pioneer species: A pioneer species is a species that is first to colonize a bare area. A typical example of pioneer species is lichen which firstly colonizes a bare rock during primary succession.

Climax community: A climax community is that community which arises during the final stages of succession and remain unchanged for a long period of time (as long as the environment remains stable). A typical example includes a forest community.

Seres: Sere refers to the overall sequence of communities that arise during the course of ecological succession. Each community that exists during ecological succession is called a seral community.

OR

In addition to zoological parks, botanical garden and wildlife safaris, the following methods are being employed for the ex-situ conservation of plants and animals:

1. Seed banks: In this method, viable seeds from different plants are preserved in a temperature and moisture controlled environment. These seeds are then stored for extended periods of time.

2. Gene banks: This method is preferred for animals. In gene banks, embryos, sperms or eggs of endangered animals are stored in the low-temperature environments.

3. Cryopreservation: In this method, pollens, embryos or tissues can be preserved in liquid nitrogen at a temperature of -196°C.

Question 15

Explain 'Integrated organic' farming as successfully practiced by Ramesh C. Dagar, a farmer in Sonepat (Haryana).

Solution:

"Integrated Organic farming" is an agricultural technique that relies on crop rotation, green manure, biological pest control and compost. In this kind of farming, the waste from one process is utilised in another process, and hence it is zero waste process. It limits the use of synthetic fertilizers and pesticides.

Ramesh Chander Dagar, an organic farmer, followed integrated organic farming and has been proven to be successful. It comprises of many practices like bee keeping, dairy management, water harvesting, composting and agriculture, which support each other and allow economic, sustainable and environment friendly venture. Cow dung is used a manure, and the plant wastes are used as compost in this practice.

Question 16

(a) Explain the mode of action of Cu^{++} releasing IUDs as a good contraceptive. How is hormone releasing IUD different from it?
(b) Why is "Saheli' a preferred contraceptive by women (any two reasons)?

Solution:

(a) Cu^{++} releasing IUDs such as CuT exert their effects in two ways:
• They can trigger phagocytosis of sperms within the uterus.

• They can also affect the fertilizing ability of sperms and suppress their motility.

In contrast to Cu^{++} releasing IUDs, hormone-releasing IUDs alter the uterus through hormonal actions such that implantation does not occur.

(b) Saheli is a preferred contraceptive because of the following reasons:
1. Minimal side effects
2. High contraceptive value

Question 17

What are 'SNPs'? Where are they located in a human cell? State' any two ways the discovery of SNPs can be of importance to humans.

Solution:

SNP refers to Single Nucleotide Polymorphism. It refers to the variation in the genome of organisms within a particular species because of changes in the sequence of a single nucleotide.

SNPs are located within the chromosomes in certain discrete locations. The discovery of SNPs can prove useful to humans in the following manner:
1. SNPs can be used to specifically identify genetic regions associated with certain

genetic disorders.
2. SNPs can also be used in forensic sciences.

Question 18

(a) Rearrange the following in the correct order of their appearance on Earth between two million years and 40,000 years back.
Neanderthals, Australopithecus, Homo erectus and Homo habilis.

(b) Which one of the above
(i) had the largest brain size
(ii) ate fruits

Solution:

a) The correct order of the appearance of human on Earth between two million years and 40,000 years back is-
Australopithecus, Homo habilis, Homo erectus, Neanderthals.

b)
i) Neanderthal man - had the largest brain size.
ii) *Australopithecus*- ate fruits.

Question 19

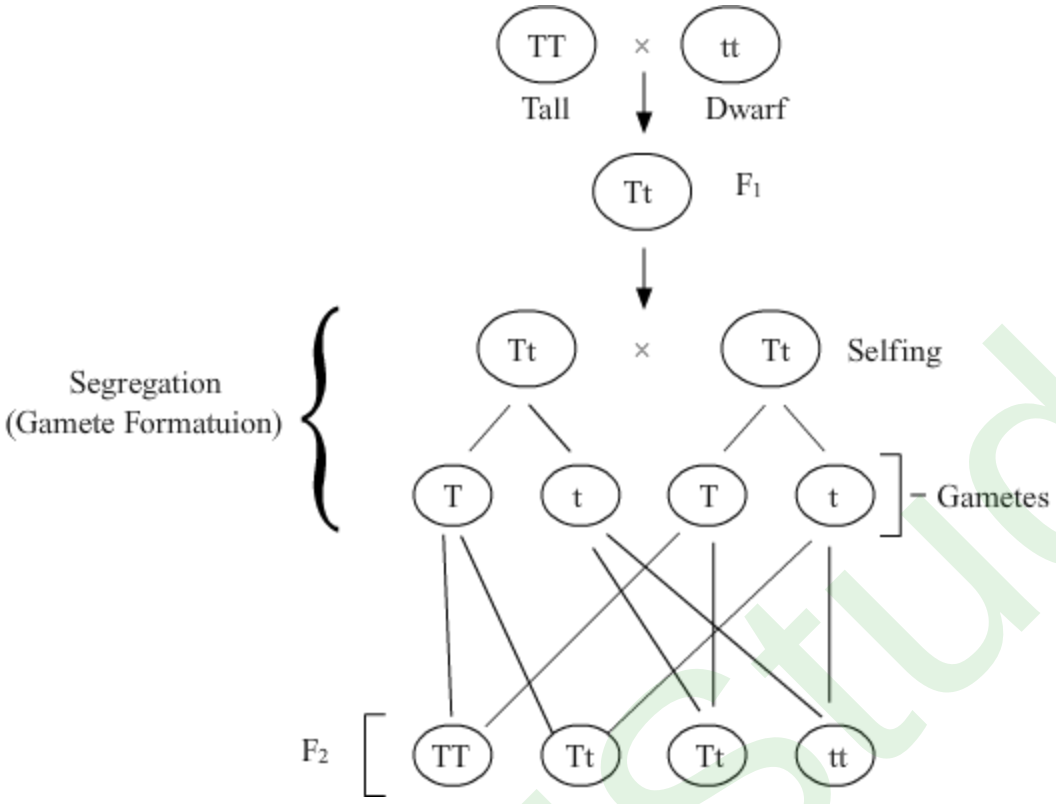
Explain Mendel's "Law of segragation" in a typical monohybrid cross with the help of a suitable example.

Solution:

Law of Segregation :
This law states that a pair of alleles of a gene stay together in the individual until gamete formation and do not mix with each other.

During gamete formation through meiosis, each allele segregates (separates) from its paired partner so that a gamete receives only one allele of the character.

Example :



Question 20

(a) Explain why bee-hives are setup on the farms for some of our crop-species. Name any two such crop species.
(b) List any three important steps to be kept in mind for successful bee keeping.

Solution:

(a) Beehives kept in crop fields during the flowering period, increase the pollination efficiency. This increases the yield of crop and honey.

Also, bees can easily collect huge amounts of nectar from the flowers of the crop in a close reach without much foraging. This increases honey production. This technique is practiced in apple and watermelon fields.

(b) Apiculture or bee keeping refers to the maintenance of hives of honeybees for the production of honey. For successful bee keeping, the following steps are necessary:

i. Accurate knowledge of nature and habit of bees
ii. Selection of a suitable location for maintaining beehives
iii. Management of beehives during different seasons

Question 21

Explain three different modes of pollination that can occur in chasmogamous flower.

OR

Explain the formation of placenta after implantation in a human female.

Solution:

(i) **Autogamy** – It is the transfer of pollen grains from the anther to the stigma of the same flower. Autogamy requires the anther and the stigma to lie close. It also requires synchrony in the pollen release and stigma receptivity. Plants like Viola, Oxalis, etc. produce two kinds of flowers—chasmogamous (with an exposed anther and stigma) and cleistogamous (which do not open at all, only autogamy occurs).

(ii) **Geitonogamy** – It is the transfer of pollen from the anther of one flower to the stigma of another flower in the same plant. Genetically, it is similar to autogamy but requires pollinating agents.

(iii) **Xenogamy** – It is the transfer of pollen grains from the anther to the stigma of a different plant. Xenogamy causes genetically different types of pollens to be brought to a plant.

OR

The formation of placenta occurs after 12 weeks of pregnancy, when the finger like projection called chorionic villi appears on the trophoblast, penetrate the endometrium lining of uterine tissue.

This chorionic villi and uterine tissue interdigitate to form the structural and functional unit between developing embryo and maternal body called placenta, which help the embryo to obtain nutrients and oxygen and remove the metabolic waste and carbon dioxide.

Question 22

"The population of a metro city experiences fluctuations in its population density over a period of time."
(a) When does the population in a metro city tend to increase?
(b) When does the population in metro city tend to decline?
(c) If 'N' is the population density at the time 't', write the population density at the time 't + 1'.

Solution:

(a) The population in a metro city will tend to increase when natality and immigration will be higher.

(b) The population in metro city will tend to decline when mortality and emigration will be higher.

(c) The equation $N_{t+1} = N_t + [(B + I) - (D + E)]$ represents the population density at time t + 1. The components of the equation are

• $\mathbf{N_{t+1}}$: Population density at time t + 1.

• $\mathbf{N_t}$: Population density at time t.

• **B**: This represents natality. Natality refers to the number of births during a given period in the population.

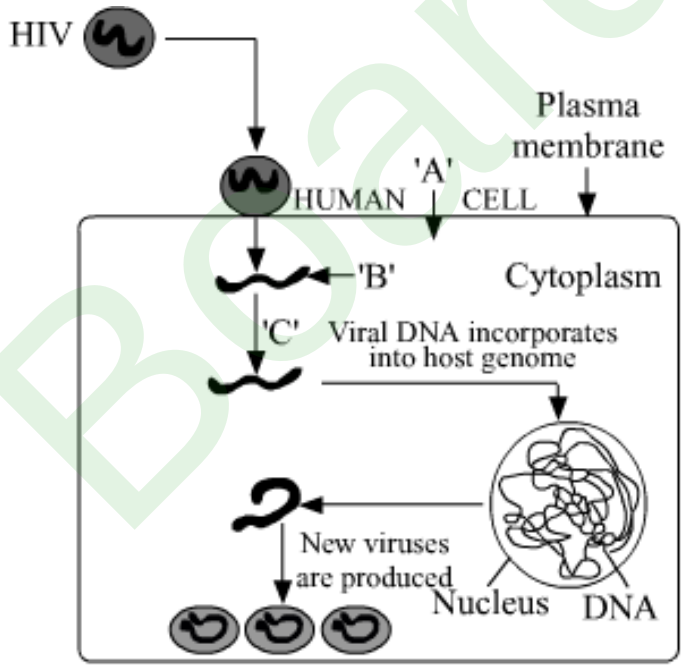
• **I**: It refers to immigration. It is the number of individuals of the same species that have come into habitat from elsewhere during the considered time period.

• **D :** This represents mortality. Mortality is the number of deaths in the population during a given period.

• **E**: It refers to emigration. It is the number of individuals of the population who left the habitat and went elsewhere during the considered time period.

Question 23

Study the diagram showing the entry of HIV into the human body and be processes that are followed :



(a) Name the human cell **'A'** HIV enters into.
(b) Mention the genetic material **'B'** HIV releases into the cell.
(c) Identify enzyme **'C'**.

Solution:

(a) HIV which is the causative agent of AIDS specifically attacks helper T-cells. So, 'A' is helper T-cells.

(b) Viral RNA is introduced into the cell. So, 'B' is RNA.

(c) Enzyme 'C' is reverse transcriptase.

Question 24

Following a road accident four injured persons were brought to a nearby clinic. The doctor immediately injected them with tetanus antitoxin.
(a) What is tetanus antitoxin ?
(b) Why were the injured immediately injected with this antitoxin?
(c) Name the kind of immunity this injection provided.

Solution:

(a) Tetanus antitoxin is solution of preformed antibodies.

(b) *Clostridium tetani*, a bacterium enters the body through cut & wounds and obstructs nerve signalling. This antitoxin neutralises the effect of tetanus toxin in the body. As the injured persons required immediate immunization in this case, so pre-formed antibodies(tetanus antitoxin) were delivered to the patients.

(c) Passive immunity would be provided in this case.

Question 25

(a) Name the insect that attacks cotton crops and causes lot of damage to the crop. How has Bt cotton plants overcome this problem and saved the crop? Explain.

(b) Write the role of gene Cry IAb.

OR

(a) Explain the different steps carried out in Polymerase Chain Reaction, and the specific roles of the enzymes used.

(b) Mention application of PCR in the field of
(i) Biotechnology

(ii) Diagnostics

Solution:

a) Cotton Bollworm is a lepidopteran larvae which is notoriously known as the major pest of cotton balls. Bt cotton plants are GMOs containing the active Cry gene from *Bacillus thuringiensis* which leads to a production of inactive insecticidal protein, which becomes active and functional due to the alkaline pH in the gut of the lepidopteran larvae.

This happens when the pest larvae feeds on the GMO Bt crop, which produces the inactive toxin as produced by the *Bacillus thuringiensis*. The functional protein inside the larvae gut binds to the surface of midgut epithelial cells leading to formation of pores in them.

Due to this the midgut epithelial cells of the insect larvae swells up and lyse, leading to the death of the larvae itself. This way it leads to control of the major insect pest cotton bollworm.

b) CryIAb gene is responsible for the control of corn borer just like the way CryIAc controls the cotton bollworm.

OR

a) Polymerase Chain Reaction (PCR)- This process is used to amplify specific DNA into million or billion copies in vitro. It was invented in 1983 by Kary Mullis.

Two sets of primers (chemically synthesised oligonucleotide stretches that are complementary to a region of DNA), enzyme DNA polymerase,and deoxynucleotides are used in this process.

• PCR consists of 3 steps:

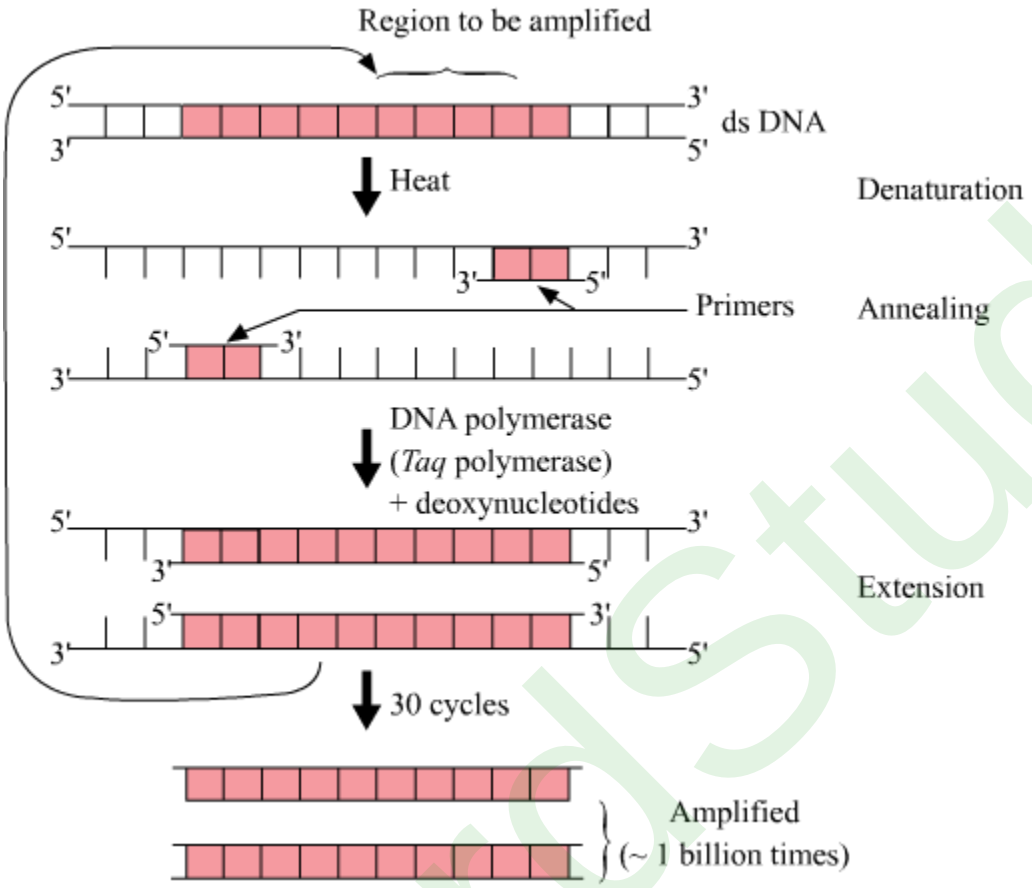
◦ Denaturation – Double helical DNA is denatured by providing high temperature. DNA polymerase does not get degraded in such high temperatures since the DNA polymerase used in this reaction is thermostable as it is isolated from thermophilic bacteria, Thermus aquaticus (Taq).

◦ Annealing- It is the step in which primers are annealed to single stranded DNA templates. Two sets of primers (small chemically synthesised oligonucleotides that are complementary to the regions of DNA) are used.

The temperature of reaction mixture is lowered to 50- 65°C for some seconds to allow annealing of primers. DNA polymerase extends the primer in 5' to 3' direction.

◦ Extension – Replication of DNA occurs in vitro.

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



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This enzyme is thermostable and can withstand the high temperature and is used in PCR in recombinant DNA technology.

b) i) In molecular biology to amplify a single or a few copies of a piece of DNA across several orders of magnitude, generating thousands to millions of copies of a particular DNA sequence.

ii) PCR is used in early diagnosis of bacteria and virus in body, when the concentration is extremely low, can be done by PCR since it amplifies the DNA several folds. It is used to detect HIV virus in suspected AIDS patients and mutations in genes in suspected cancer patients.

Question 26

(a) Describe the process of double fertilisation in angiosperms.
(b) Trace the development of polyploidal cell that is formed after double fertilisation in a non-albuminous seed and albuminous seed.

OR

(a) List any two reasons other than physical and congenital disorders for causing infertility in couples.
(b) Explain how IVF as a technique helped childless couples in having children.
(c) Compare GIFT with ICSI.

Solution:

a) Double fertilisation is a process unique to angiosperms only. During the process of double fertilisation following events occur:

(i) The two generative cells carried by the pollen tube moves towards the embryo sac.

(ii) Pollen tube carrying the two male gametes (generative cells) is guided into the embryo sac by the filliform apparatus of the two synergid cells on either side of the female egg cell.

(iii) As the first generative cell is carried over the filliform apparatus towards the female gamete, the two fuses (undergoes syngamy) or fertilises to form the diploid zygote.

(iv) The second generative cell continues to move further into the embryo sac.

(v) Meanwhile the two polar nuclei within the central cell of the embryo sac fuses with each other to form a secondary nucleus.

(vi) The second generative cell fuses with the diploid secondary nucleus in an event termed as triple fusion (as three individual haploid nuclei have fused with each other), leading to the formation of a triploid endosperm nucleus.

These two consecutive events of syngamy and triple fusion are together termed as double fertilisation.

b) The triploid endosperm nucleus formed during double fertilisation leads to the formation of the triploid Primary Endosperm Cell (PEC).

This PEC undergoes repeated mitotic divisions to form a multicellular, triploid, endosperm. This serves as the nutritive tissue for the budding embryo within the seed.

In case of albuminous seeds, endosperm is retained and in many cases a rudimentary cotyledon often termed as scutellum is derived from it in case of monocots.

In case of non-albuminous seeds, this multicellular triploid endosperm is almost completely utilised or digested or absorbed to aid in the formation of fleshy cotyledon tissue as in the case of most dicot seeds.

OR

(a) Infertility is caused by defects in the male or female or in both. Two reasons other than physical and congenital disorders for causing infertility in couples:

- Alcoholism which causes problems in spermatogenesis.
- Early miscarriage.

(b) InVitro Fertilization (IVF) is a technique in which the fusion of ovum and sperm is done outside the body of female to form a zygote and allowed to grow until a certain celled stage (in Vitro) and then planted in the uterus where it develops into a foetus which in turn develops into a child.

This technique has helped childless couples who had no chances of natural fertilization either because of low success rate of fertilization or because of inability to produce sperm or egg (in which case they could use a donor sperm/egg). Such babies are called "test tube babies".

(c) Both Gamete Intra Fallopian Transfer (GIFT) and Intra Cytoplasmic Sperm Injection (ICSI) are assisted reproductive technologies to solve infertility problems.

GIFT	ICSI
- A combination of two oocytes along with 200000-500000 sperm inserted into the distal end of the fallopian tube through laproscope. - Fertilization of gametes takes place in vivo. - Success rate is high 60-70%	- One single spermatozoan or spermatid is directly injected into the cytoplasm of oocyte through injecting micropipette. - The fusion of gametes are done in vitro. - Success rate is less 20-30%

Question 27

(a) Why did T.H. Morgon select Drosophila melanogaster for his experiments?
(b) How did he disprove Mendelian dihybrid F_2 phenotypic ratio of 9 : 3 : 3 : 1? Explain giving reasons.

OR

(a) List any four major goals of Human Genome project.
(b) Write any four ways the knowledge from HGP is of significance for humans.
(c) Expand BAC and mention its importance.

Solution:

a) T. H. Morgon selected *Drosophila melanogaster* as the model organism for his genetic studies because of the following reasons:

(i) *Drosophila* is easy and suitably grown on cheap synthetic medium under laboratory conditions in all seasons.

(ii) *Drosophila* has a short life cycle of two weeks only.

(iii) High number of progenies are generated per generation making it easy to observe variation.

(iv) Male and female flies can be easily distinguished from each other.

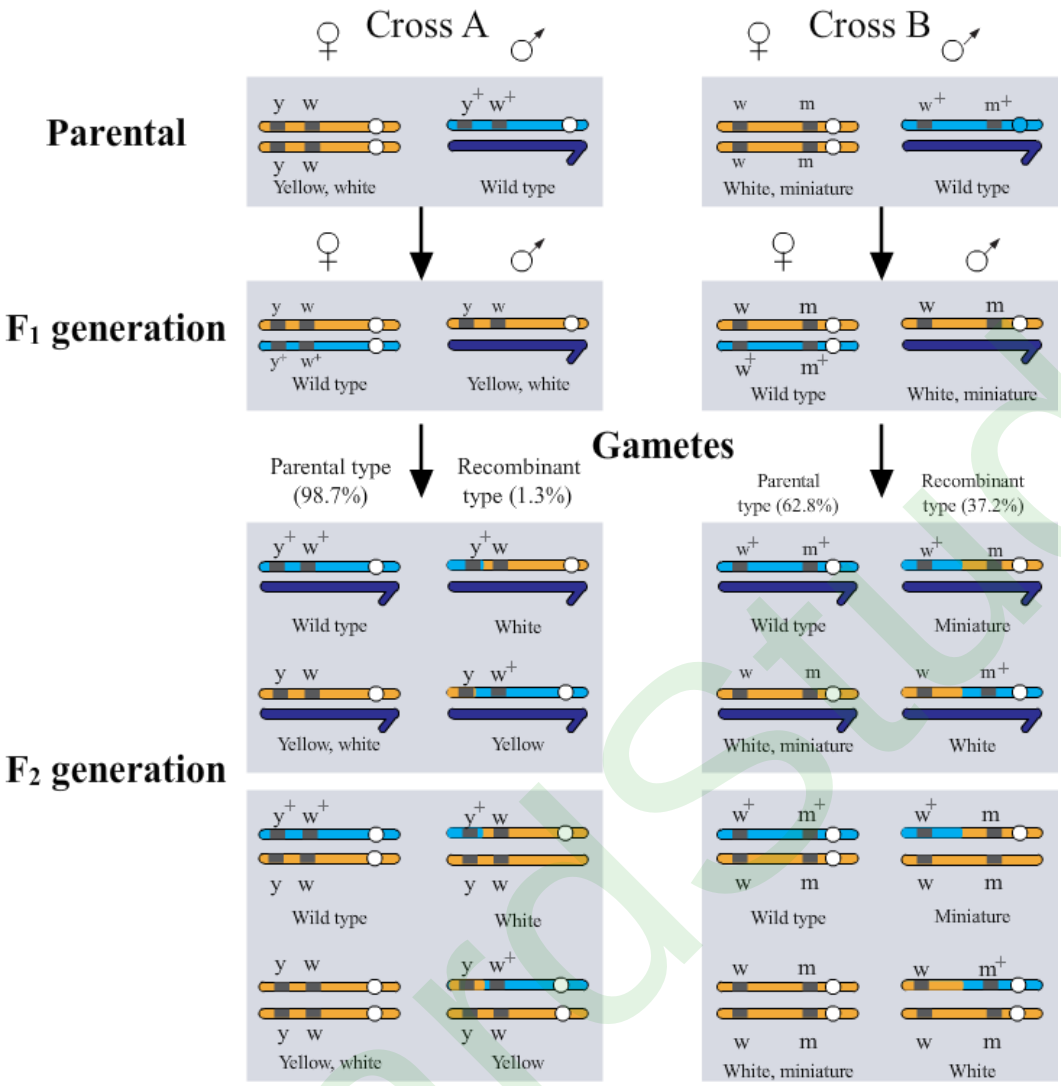
(v) Observable genetic variations can be easily noticed using a low power microscope or a hand lens.

(vi) Four pair of chromosomes in diploid organisms makes *Drosophila* a fairly simple model for genetic studies.

b) Morgan observed that for many genetic characters observed in case of *Drosophila*, the typical mendelian dihybrid cross ratio of 9:3:3:1 is not observed. This was proved by test cross of F_1 generation flies of dihybrid cross.

If the two genes involved in the dihybrid cross are assorting independently then the test cross of the F_1 generation individuals will result in off springs with 50% parental genetic combination and 50% recombinants, but that is not the case as observed by Morgan in case of *Drosophila*.

This can be demonstrated as follows:



OR

a) Main goals of Human genome project (HGP) are:

To identify all the genes (approximately 20,000-25,000) present in the human DNA.
To determine the accurate sequence of 3 billion chemical base pairs which make up the human genome

To store the above information in the form of databases.
To improve the tools available for data analysis

(b) The four important advantages of the Human genome project (HGP) are:

1. HGP has led to better understanding of Human Biology and Genetics in general.
2. HGP has paved the way for personalised medicine in future based on one's own

genome.

3. HGP has shed a lot of light on human evolution and phylogenetics.

4. HGP has provided greater insights into the field of genetic disorders and their cures.

c) BAC stands for Bacterial Artificial Chromosome. It is an artificially constructed vector containing the origin of replication & selectable marker for identification.

It is capable of carrying large DNA fragments and can replicate easily inside a bacterial cell.

These vectors are used in the human genome project for cloning large chunks of fragmented human genome with ease.