

**Class XII Session 2023-24**  
**Subject - Biology**  
**Sample Question Paper – 7**

**Maximum Marks: 70**

**Time: 3 Hours**

**General Instructions:**

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

**SECTION – A**

1. Two closely related different species cannot live for long duration in the same niche or habitat. This law is called

- (a) Allen's law
- (c) Competitive exclusion principle
- (b) Gloger rule
- (d) Weismann's theory.

2. Match column I with column II and select the correct option from the given codes.

Column I		Column II	
A.	Dihybrid test cross	(i)	9 : 3 : 3 : 1
B.	Law of segregation	(ii)	Dihybrid cross
C.	Law of independent assortment	(iii)	1 : 1 : 1 : 1
D.	ABO blood group in man	(iv)	Purity of gametes
		(v)	Multiple allelism

- (a) A-(iii), B-(iv), C-(ii), D-(v)
- (b) A-(i), B-(iv), C-(ii), D-(v)
- (c) A-(iii), B-(ii), C-(iv), D-(v)
- (d) A-(ii), B-(v), C-(iii), D-(i)

3. The term 'immunity' refers to

- (a) mutualism between host and parasite
- (b) ability of the host to fight the disease causing organisms
- (c) ability of the parasite to survive within a host
- (d) a fatal disease.

4. Genes with multiple phenotypic effects are known as

- (a) hypostatic genes
- (b) duplicate genes
- (c) pleiotropic genes
- (d) complementary genes.

5. Productivity at the second trophic level is always

- (a) greater than the productivity at the first trophic level
- (b) less than the productivity at the first trophic level
- (c) equal to the productivity at the first trophic level
- (d) extremely variable compared to the productivity at the first trophic level.

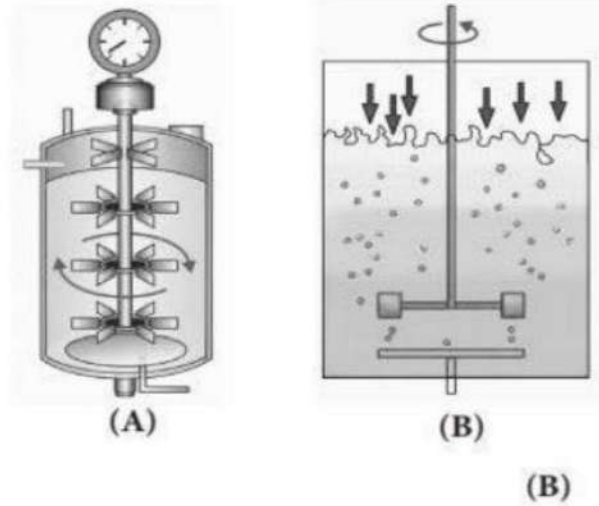
6. A sewage treatment process in which a part of decomposer bacteria present in the wastes is recycled into the starting of the process is called

- (a) primary treatment
- (b) activated sludge treatment
- (c) tertiary treatment
- (d) none of these.

7. Statin, a blood-cholesterol lowering agent, is commercially obtained from

- (a) *Trichoderma polysporum*
- (b) *Acetobacter aceti*
- (c) *Clostridium butyricum*
- (d) *Monascus purpureus*.

8. Identify the figures (A) and (B) and select the correct option.



- |                                     |                                 |
|-------------------------------------|---------------------------------|
| (a) Sparged stirred-tank bioreactor | Simple stirred-tank bioreactor  |
| (b) Sparged stirred-tank bioreactor | Sparged stirred-tank bioreactor |
| (c) Simple stirred-tank bioreactor  | Sparged stirred-tank bioreactor |
| (d) Simple stirred-tank bioreactor  | Simple stirred-tank bioreactor  |

9. The permissible use of the technique amniocentesis is for

- (a) detecting sex of the unborn fetus
- (b) artificial insemination
- (c) transfer of embryo into the uterus of a surrogate mother
- (d) detecting any genetic abnormality.

10. Find the correct palindromic sequence for the given DNA segment.

5'ATTGCAAT3'

- (a) 5'GAACGTTA 3' (b) 3'TAACGTTA 5' (c) 5'AAACGTTT 3' (d) 3'ATTGCAAT 5'

11. The age pyramid with broad base indicates

- (a) high percentage of old individuals
- (b) low percentage of young individuals
- (c) a stable population
- (d) high percentage of young individuals.

12. The primary producers of the deep-sea hydrothermal vent ecosystem are

- (a) green algae
- (b) chemosynthetic bacteria

- (c) blue-green algae
- (d) coral reefs.

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

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

13. Assertion: Production ecology deals with the productivity.

Reason: Desert has lowest productivity.

14. Assertion: The development of embryo sac from a single functional megaspore is termed as monosporic development.

Reason: In monosporic (Polygonum) type of embryo sac development, usually the megaspore which is situated towards micropylar end remains functional.

15. Assertion: The endometrium undergoes cyclical changes during menstrual cycle.

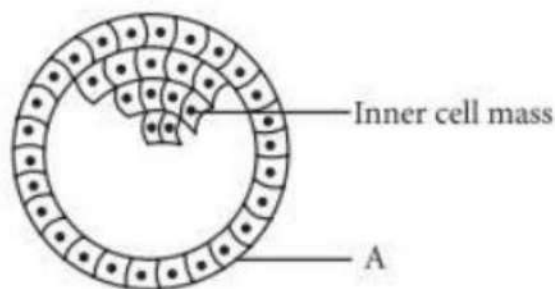
Reason: The myometrium exhibits strong contractions during delivery of the baby.

16. Assertion: Turner's syndrome is caused due to absence of any one of the X and Y sex chromosome.

Reason: Turner's syndrome is an example of aneuploidy.

## SECTION-B

17. Refer to the following figure and answer the questions that follow:



- (i) Name the stage of human embryo the figure represents. Identify 'A' in the figure and mention its functions.
- (ii) Where are the stem cells located in this figure?

18. A cross between a red flower bearing plant and a white flower bearing plant of *Antirrhinum* produced all plants having pink flowers. Work out a cross to explain how this is possible.

19. Name an allergen and write the response of the human body when exposed to it.
20. (a) How is an exonuclease functionally different from an endonuclease?  
(b) Give an example of any two endonucleases other than Sal I.
21. Construct a pyramid of numbers considering a big banyan tree supporting a population of insects, small birds and their predators.  
Explain 'standing crop' in an ecosystem. Draw a pyramid of biomass when a small standing crop of phytoplanktons supports large standing crop of zooplanktons in the sea.

### SECTION – C

22. (a) Differentiate between geitonogamy and xenogamy.  
(b) Write the difference in the characteristics of the progeny produced as a result of the two processes.
23. (a) Differentiate between a template strand and coding strand of DNA.  
(b) Mention the contribution of genetic maps in human genome project.
24. (a) Why are transgenic animals so called?  
(b) Explain the role of transgenic animals in (i) vaccine safety and (ii) biological products with the help of an example each.
25. Explain the genetic basis of blood groups in human population.
26. (a) How many number of nuclei are present in a fully developed male gametophyte of angiospermic plants?  
(b) How many meiotic divisions are required for the formation of 400 pollen grains?

Draw a well labelled diagram of L.S. of embryo of grass.

### OR

27. (a) Name the two growth models that represent population growth and draw the respective growth curves they represent.  
(b) State the basis for the difference in the shape of these curves.  
(c) Which one of the curves represent the human population growth at present? Do you think such a curve is sustainable? Give reason in support of your answer.
28. (a) Why is there a fear amongst the guardians that their adolescent wards may get trapped in drug/alcohol abuse?  
(b) Explain 'addiction' and 'dependence' in respect of drug/alcohol abuse in youth.

## SECTION – D

Q. No. 29 and 30 are case based questions. Each question has 3 subparts with internal choice in one subpart.

29. Mendelism has certain limitations. Each trait controlled by atleast two alleles is not universally applicable. There are few exceptions to law of dominance which was discovered after Mendel. Incomplete dominance and codominance are such examples.

	Pattern of inheritance	Monohybrid F <sub>1</sub> phenotypic expression
(i)	Codominance	X
(ii)	Y	The progeny resembled only one of the parents.
(iii)	Incomplete dominance	Z

(a) Identify X, Y and Z in the given table.

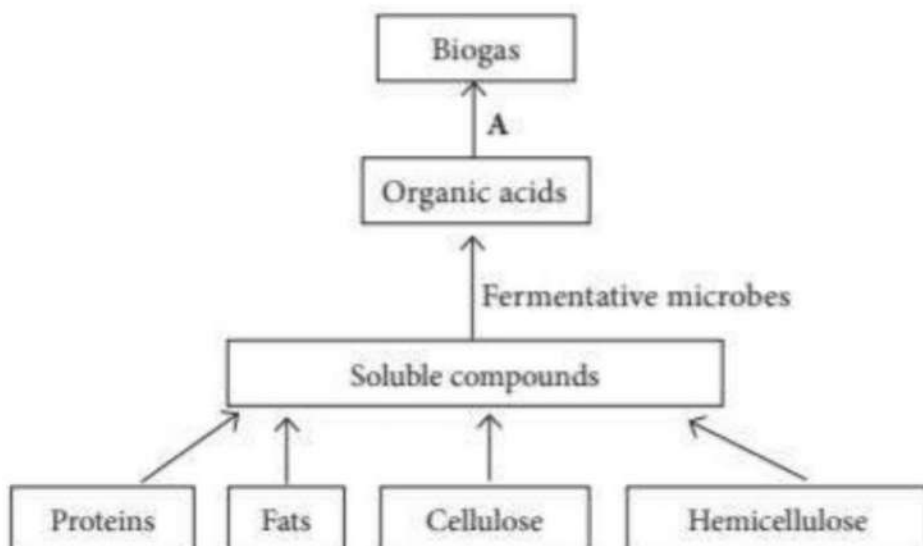
OR

Give one example where Y pattern of inheritance is seen.

(b) Discuss inheritance pattern of ABO blood groups shown by humans.

(c) Name the pattern of inheritance shown by flower colour of snapdragon. Explain with the help of cross upto F<sub>2</sub> generation.

30. Villagers in a place near Chambur started planning to make power supply for agricultural purposes from cow dung. They have started a biogas plant for the purpose. Study the given flow chart for biogas production and answer the following questions.



- (a) Name the group of bacteria (A) responsible for biogas production.
- (b) What is the composition of biogas?
- (c) How the bacteria responsible for biogas production is useful to cattle?

**OR**

Why biogas production is more common in rural areas?

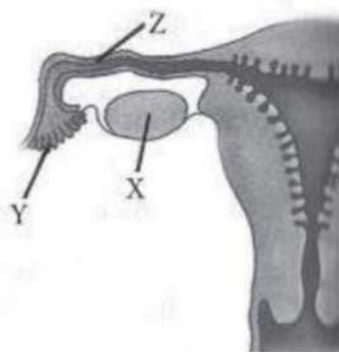
### SECTION-E

31. Describe the various stages involved in the commercial production of human insulin.

**OR**

Explain the application of biotechnology in producing Bt cotton.

32. (a) The given diagram shows a part of the human female reproductive system.



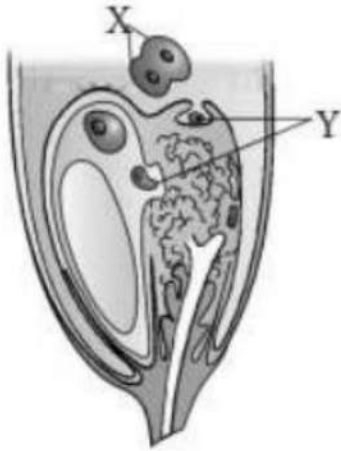
- (i) Identify the labelled part X, Y and Z. Also name the gamete cells that would be present in 'X' if taken from a newborn baby.
  - (ii) What is the function of Y?
  - (iii) Write the events that take place in Z.
- (b) Name the muscular and the glandular layers of human uterus. Which one of these layers undergoes cyclic changes during menstrual cycle? Name the hormone essential for the maintenance of this layer.

**OR**

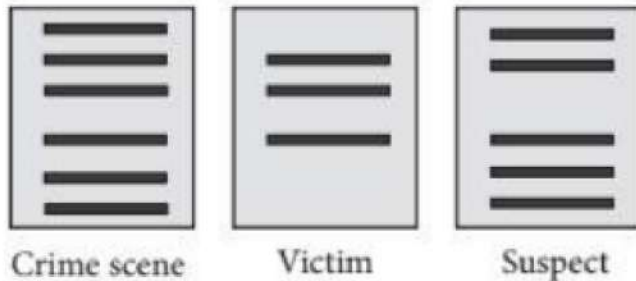
(a) Refer to the given figure and answer the following questions:

- (i) Identify the labelled parts X and Y.
- (ii) Write the role of X and Y.
- (iii) Draw labelled prior stage of the given figure.

(b) Why is fertilisation in an angiosperm referred to as double fertilisation?  
Mention the ploidy of the cells involved.



33. Blood samples from a crime scene was collected and DNA analysis for the same was done. Given below are the marker profiles collected at the crime scene of the victim and a suspect.



- (a) What will you conclude on the basis of above observation?  
(b) Discuss how this technique helps in determining that the blood samples picked up from the crime scene belong to a single person or two different persons.  
(c) How can be the maternal and paternal identity disputes sorted out using the technique used above?

**OR**

- (a) Select the homologous structures from the combinations given below:  
(i) Forelimbs of whales and bats  
(ii) Tuber of potato and sweet potato  
(iii) Eyes of octopus and mammals  
(iv) Thorns of Bougainvillea and tendrils of Cucurbita.  
(b) State the kind of evolution represent by the homologous structures.

(c) What are analogous structures? How are they different from homologous structures? Provide one example for each.

## SOLUTIONS

1. (c) Gause's "competitive exclusion principle" states that two closely related species competing for the same resources cannot co-exist indefinitely and the competitively inferior one will be eliminated eventually. Two species can live in same habitat but not in the same niche. More similar the two niches are, severe the competition is.
2. (a)
3. (b)
4. (c)
5. (b) Productivity at second trophic level is always less than productivity at first trophic level. This is because only 10% of energy is transferred from one trophic level to another. Thus, decrease in energy would result in decrease in productivity.
6. (b) The activated sludge system, a part of secondary treatment, is one of the widely used aerobic treatment systems for wastewater in which very vigorous aeration of the sewage is done. The sewage is passed into an aeration tank from primary settling tank. The flocs are allowed to settle down in secondary settling tank. In settling tank, the bacterial flocs are allowed to undergo sedimentation. The effluent or supernatant is generally passed into natural water bodies like rivers and streams. The sediment of settling tank is called activated sludge. A part of it is used as inoculum in aeration tanks. The remaining part is passed into a large tank called anaerobic sludge digesters.
7. (d): Statins produced by the yeast *Monascus purpureus* have been commercialised as blood cholesterol lowering agents. Statins act by competitively inhibiting the enzyme responsible for synthesis of cholesterol.
8. (c)
9. (d): Amniocentesis is withdrawal of a sample of the fluid (amniotic fluid) surrounding a fetus in the uterus by piercing the amniotic sac through the abdominal wall, under direct ultrasound guidance. As the amniotic fluid contains cells from the fetus, cell culture enables chromosome patterns to be studied so that prenatal diagnosis of chromosomal abnormalities can be made.
10. (b)
11. (d): Age pyramid is a graphic representation of abundance of individuals of different age groups with pre-reproductive individuals at the base, reproductive individuals in the middle and post-reproductive individuals at the top. Triangular age pyramid has high proportion of pre-

reproductive individuals, moderate number of reproductive individuals and fewer post-reproductive individuals. It represents young or rapidly growing population.

12. (b)

13. (b) Production ecology is the study of rate of biomass production of various trophic levels as well as the whole ecosystem. It includes the percentage trapping of solar energy, gross primary productivity, net primary productivity, secondary productivity at each trophic level and the total productivity or increase in biomass. The ecosystem with lowest productivity is a desert due to poor vegetation.

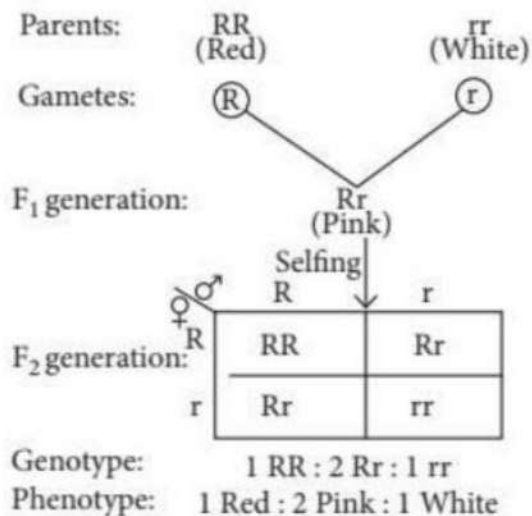
14. (c) In monosporic (Polygonum) type of development of embryo sac, only one megaspore situated towards chalazal end remains functional. The remaining three megaspores gradually degenerate and finally disappear. The functional haploid megaspore enlarges in size and by means of three successive mitotic divisions, gives rise to an eight-nucleate embryo sac. This type of embryo sac development occurs in a majority of flowering plants and the common example is Polygonum.

15. (b)

16. (d): Turner's syndrome is one of the example of aneuploidy that occurs due to absence of X chromosome. Individuals having a single X chromosome  $2A+XO$  (45) have female sexual differentiation but ovaries are rudimentary. Other associated phenotypes of this condition are short stature, webbed neck, broad chest, lack of secondary sexual characteristics and sterility. Thus, any imbalance in the copies of the sex chromosomes may disrupt the genetic information necessary for normal sexual development.

17. (i) Blastocyst A is trophoblast. It helps in attachment of the blastocyst to the endometrium of uterine wall, help to provide nutrition to the embryo and later forms extra embryonic membranes namely chorion and amnion and parts of placenta. (ii) Inner cell mass.

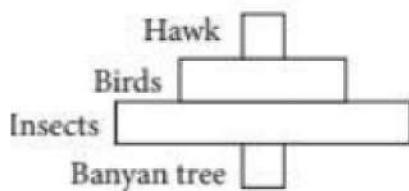
18. Neither of the two alleles of a gene is completely dominant over the other, hence the phenomenon is known as incomplete dominance. Incomplete dominance in *Antirrhinum* is explained below:



19. Pollen grain is an allergen. Exposure to pollen causes hay fever. It is the form of allergy due to pollen of grasses, trees and other plants. It is characterised by inflammation of the membrane lining the nose and sometimes of the conjunctiva. The symptoms are sneezing, running nose and watering eyes due to release of histamine.

20. (a) Exonucleases remove nucleotides from the ends of the DNA whereas endonucleases make cuts at specific positions within the DNA. (b) Two examples of endonucleases other than Sall are EcoRI and HindII.

21. In the given case, pyramid of numbers will be spindle-shaped as shown here.



**OR**

Standing crop refers to mass of living material at a particular trophic level at a particular time. It is measured as biomass or the number in a unit area. Pyramid of biomass in sea is inverted as shown here.

Standing crop refers to mass of living material at a particular trophic level at a particular time. It is measured as biomass or the number in a unit area. Pyramid of biomass in sea is inverted as

shown here.

Carnivores 12 g/m <sup>3</sup>
Zooplanktons 8 g/m <sup>3</sup>
Phytoplanktons 4 g/m <sup>3</sup>

22. (a) Differences between geitonogamy and xenogamy are as follows:

	Geitonogamy	Xenogamy
(i)	It is pollination between two flowers of the same plant.	It is pollination between two flowers of different plants.
(ii)	The flowers are genetically similar.	The flowers are genetically different.
(iii)	It is genetically self pollination.	It is genetically cross pollination.

(b) In geitonogamy, pollination between the neighbouring flowers of the same plant takes place. Ecologically, it is a cross-pollination as it requires pollinating agents. But genetically it is self pollination as there is no mingling of genes. On the other hand, in xenogamy pollination between two flowers of different plants takes place and therefore a mingling of two sets of parental characteristics takes place resulting in healthier progeny. So, the progeny obtained from the process of xenogamy give higher yield with better varieties and advanced characters than that of the progeny obtained by geitonogamy.

23. (a) Differences between template strand and coding strand are as follows:

	Template strand	Coding strand
(i)	Strand of DNA having 3' → 5' polarity.	Strand of DNA having 5' → 3' polarity.
(ii)	Participates in transcription.	Do not take part in transcription.

(b) Genetic maps have helped in gene sequencing, DNA fingerprinting, tracing human history, etc.

24. (a) Transgenic animals are those animals which contain in their genome, a foreign gene introduced by recombinant DNA technology. Such gene is called transgene. Examples of transgenic animals are transgenic mice and transgenic rabbit, etc.

(b) (i) Genetically modified organisms such as mice are being formed for use in testing the

safety of vaccines before they are used on human beings. Transgenic mice are being used to test the safety of the polio vaccine.

(ii) Transgenic animals that produce useful biological products can be created by the introduction of the DNA segment (or gene) which code for a particular product such as human protein ( $\alpha$ -1-antitrypsin) used to treat emphysema. Similar attempts are being made for treatment of phenylketonuria (PKU) and cystic fibrosis.

25. ABO blood groups are controlled by gene I. The gene I has three alleles  $I^A$ ,  $I^B$  and  $i$ . This phenomenon is known as multiple allelism. The blood groups and their possible genotypes are given below in the table:

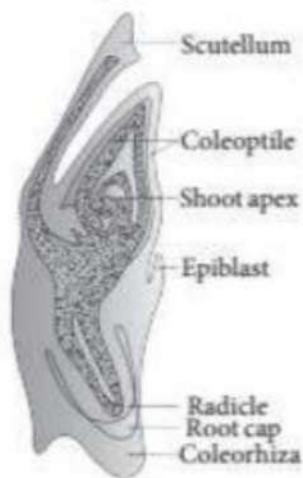
Blood group	Genotypes (possible)
A	$I^A I^A$ or $I^A i$
B	$I^B I^B$ or $I^B i$
AB	$I^A I^B$
O	$ii$

26. (a) Fully developed male gametophyte is a pollen grain with pollen tube carrying male gametes. It carries 3 nuclei, i.e., one tube nucleus and two nuclei of each male gamete.

(b) 100 meiotic divisions are required to form 400 pollen grains. Each pollen mother cell on meiotic division gives rise to 4 pollen grains.

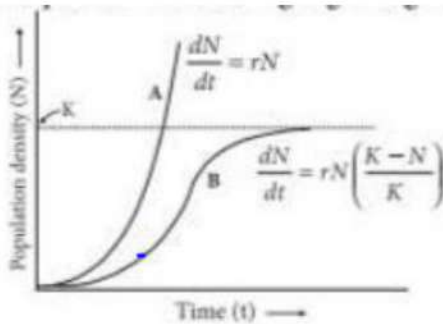
**OR**

The well labelled diagram of L.S. of embryo of grass is as follows:



27. (a) Two growth models of population growth are as follows:

- (i) A: J-shaped curve showing exponential growth  
 (ii) B: S-shaped curve showing logistic growth



- (b) Difference in shape of curves is due to difference in amount of resources available.  
 (c) Human population growth represents B (logistic growth form). This curve is sustainable as resources are limited and environment cannot support population beyond carrying capacity.

28. (a) Guardians fear that their adolescent wards may get trapped in drug/alcohol abuse because it has been observed that use of drugs has increased especially among youth. Adolescence (age group 12-18 years) is the period which is accompanied by several biological and behavioural changes. This is also a very vulnerable phase of mental and psychological development of an individual. Curiosity, need for adventure and excitement, experimentation and exposure to media are some common causes that motivate the youngsters towards drug and alcohol abuse. Stress (to excel in academics or examination) has played major role in persuading youngsters to try alcohol and drugs.

(b) The prolonged use of drugs/alcohol may lead to the dependence of body upon them. Addiction is the habitual, physiological and psychological dependence on substance or practice which is beyond voluntary control. Addiction is a chronic, progressive and sometimes fatal disorder with both genetic and environmental roots. It manifests as a compulsion that drives an individual to continue to behave in a way that is harmful to self and loved ones, despite an intense desire to halt that behaviour. Medically, addiction is of three types: tobacco addiction, alcohol addiction and drug addiction. Dependence is the tendency of the body to manifest a characteristic and unpleasant withdrawal syndrome if regular dose of drug or alcohol is abruptly discontinued.

29. (a) X-Both the forms of a trait are equally expressed in  $F_1$  generation.

Y-Dominance

Z-Phenotypic expression of  $F_1$  generation is somewhat intermediate between the two parental forms of a trait.

OR

Dominance(Y) is seen when true breeding tall pea plant is crossed with true breeding dwarf pea plant.

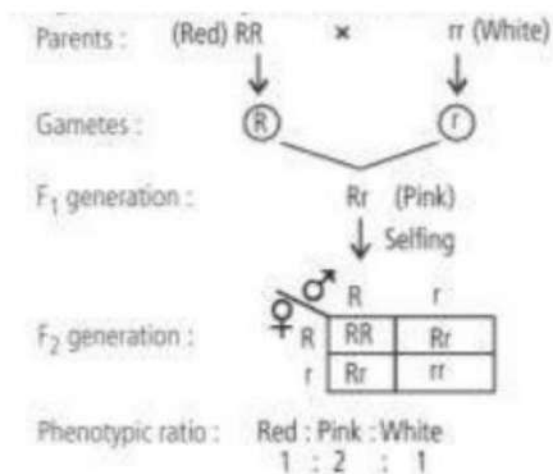
(b) ABO blood group in humans show following patterns of inheritance:

(i) Dominance: The alleles  $I^A$  and  $I^B$  both are dominant over allele  $i$  as  $I^A$  and  $I^B$  form antigen A and antigen B respectively but  $i$  does not form any antigen.

(ii) Codominance: Both the alleles  $I^A$  and  $I^B$  are codominant as both of them are able to express themselves in the presence of each other in blood group AB ( $I^A I^B$ ) by forming antigens A and B.

(iii) Multiple allelism: It is the phenomenon of occurrence of a gene in more than two allelic forms on the same locus. The ABO blood groups in humans are determined by three different allelic forms  $I^A$ ,  $I^B$  and  $i$ .

(c) Inheritance of flower colour in snapdragon is a good example of incomplete dominance.



30. (a) Methanogens or A (e.g., Methanobacterium) grow anaerobically on cellulosic material and produce large amount of methane along with CO<sub>2</sub> and H<sub>2</sub>.

(b) Biogas is a mixture of gases, composed mainly of methane alongwith carbon dioxide and hydrogen.

(c) Methanogens are also present in rumen of cattle. These bacteria help in the breakdown of cellulose present in food of cattle and thus, play important role in nutrition of cattle.

**OR**

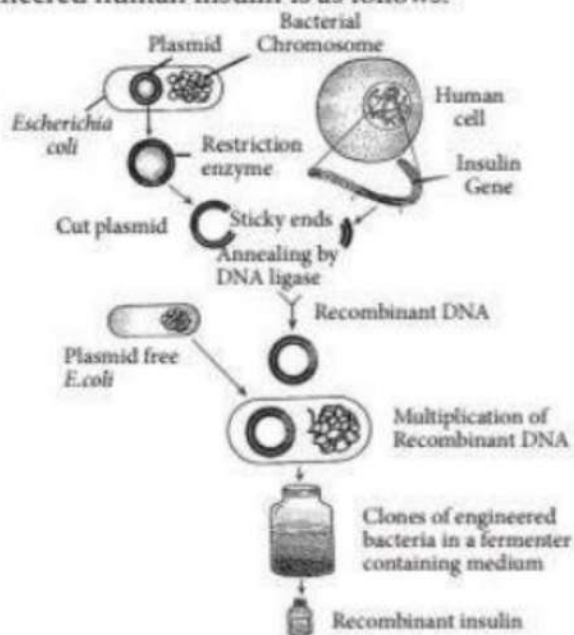
The excrete of cattle (dung) is rich in methanogen bacteria which is required areas, so, biogas plants are more often built in rural areas.

31. Human insulin is made up of 51 amino acids arranged in two polypeptide chains, chain A having 21 amino acids and chain B with 30 amino acids. This hormone develops from a storage product called proinsulin which has three chains A, B and C. C chain with 33 amino acids is removed prior to insulin formation. The main challenge for production of insulin using rDNA

techniques was getting insulin assembled into mature form. In 1983, Eli Lilly an American company, first prepared two DNA sequences corresponding to A and B chains of human insulin and introduced them in plasmids of *Escherichia coli* to produce insulin chains. Chains A and B were produced separately, extracted and combined by creating disulfide bonds to form human insulin (humulin). It is recombinant DNA technological process. The recombinant DNA technology process has made great impact in the area of health care by mass production of safe and more effective therapeutic drugs. Further, the recombinant therapeutics do not induce unwanted

immunological responses.

Flow chart showing preparation of genetically engineered human insulin is as follows:



OR

Bt cotton is produced by using biotechnology. Soil bacterium *Bacillus thuringiensis* produces proteins that kill certain insects like lepidopterans (tobacco budworm, armyworm), coleopterans (beetles) and dipterans (flies, mosquitoes) etc. *B. thuringiensis* forms some protein crystals that contain a toxic insecticidal protein. This toxin does not kill the bacteria because it exists as inactive protoxins in them. But, once an insect ingests the crystals, it is converted into an active form of toxin due to the alkaline pH of its alimentary canal that solubilises the crystals. Through genetic engineering Bt toxin genes were isolated from *Bacillus thuringiensis* and incorporated into the several crop plants such as cotton. The choice of genes depends upon the crop and

targeted pest, as most Bt toxins are insect-group specific. The toxin is coded by a gene named cry. Two cry genes cryI<sub>Ac</sub> and cryII<sub>Ab</sub> have been incorporated in cotton. The genetically modified crop is called Bt cotton as it contains Bt toxin genes against cotton bollworms.

32. (a) X, Y and Z are respectively, ovary, fimbriae and ampullary isthmic junction

(i) Primary oocytes will be present in ovary (X) of a newborn baby.

(ii) Y (fimbriae) helps in collection of ovum after fertilisation.

(iii) Z (the ampullary-isthmic junction) is the site of fertilisation in humans.

(b) The muscular layer of human uterus is myometrium and glandular layer is endometrium.

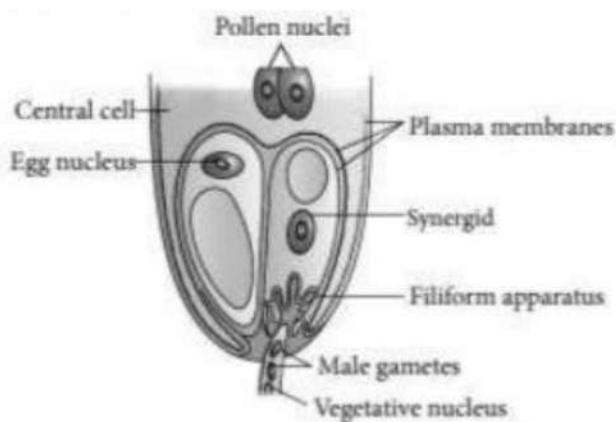
The endometrium undergoes cyclical changes during menstrual cycle. Progesterone is essential for the maintenance of endometrium.

### OR

(a) (i) The given figure represents discharge of male gametes and their movements within embryo sac. Labelled part X is fusing polar nuclei and Y is male gametes.

(ii) Male gametes take part in double fertilisation. One male gamete fuses with egg cell to form zygote. Polar nuclei fuse with male gamete to form endosperm.

(iii) Enlarged view of an egg apparatus showing entry of pollen tube into a synergid:



(b) In angiosperms, one of the male gametes fuses with the egg cell to form the zygote (syngamy). The other male gamete fuses with the two polar nuclei to produce a triploid primary endosperm nucleus (triple fusion). Since two types of fusions, syngamy and triple fusion take place in the same embryo sac, the phenomenon is termed as double fertilisation. The ploidy of the cells involved in double fertilisation are as follows:

(i) Male gamete - Haploid (n)

(ii) Egg cell - Haploid (n)

(iii) Central cell - Diploid (2n)

33. (a) The banding pattern for victim's and suspect's samples, both match with that obtained at the crime scene. Hence, we can conclude that crime scene has both victim's and suspect's sample.

(b) Variable number of tandem repeats (VNTRS) describe the individual loci where alleles are composed of tandem repeats that vary in the number of core units. It forms the basis of DNA fingerprinting. VNTRS show high degree of polymorphism. The DNA is isolated from blood obtained from crime scene. It is cleaved with a specific enzyme and hybridised with a probe consisting of the core repeat. After hybridisation with the radiolabelled VNTR probe and autoradiography, bands of various sizes are formed. The bands form a characteristic pattern, which varies from person to person. If the patterns developed from two sample is different then it confirms that samples belong to two different persons.

(c) DNA fingerprinting can sort out dispute of maternity and paternity, which is based on the variable numbers of tandem repeats in genome. The procedure in DNA-fingerprinting includes the following:

(i) Extraction - DNA is extracted from the cells in a high-speed, refrigerated centrifuge.

(ii) Amplification - Many copies of the extracted DNA are made by polymerase chain reaction.

(iii) Restriction digestion - DNA is cut into fragments with restriction enzymes into precise reproducible sequences.

(iv) Separation of DNA sequences/restriction fragments The cut DNA fragments are introduced and passed through electrophoresis containing agarose polymer gel, the separated fragments can be visualised by staining them with a dye that shows fluorescence under ultraviolet radiation.

(v) Southern blotting - The separated DNA sequences are transferred on a nitrocellulose or nylon membrane.

(vi) Hybridisation - The nylon membrane is immersed in a bath and radioactive probes are added, these probes target a specific nucleotide sequences that is complementary to them.

(vii) Autoradiography The nylon membrane is pressed on an X-ray film and dark bands develop at the probe sites. After hybridisation with the radiolabelled Variable Number of Tandem Repeats (VNTR) probe and autoradiography, bands of various sizes are formed. The bands form a characteristic pattern which varies from individual to individual. By analysing the banding pattern maternity and paternity can be identified.

**OR**

(a) Forelimbs of whales and bats and thorns of Bougainvillea and tendrils of Cucurbita are homologous organs.

(b) Homologous structures represent divergent evolution, indicating common ancestry, having same fundamental structure but different function.

(c) Differences between analogous structures and homologous structures are:

	<b>Analogous structures</b>	<b>Homologous structures</b>
(i)	They show superficial resemblance.	They differ morphologically.
(ii)	Their internal structure is quite different.	They have similar internal structure.
(iii)	They develop in unrelated organisms.	They develop in related organisms.
(iv)	Stages in the development are different.	Stages in the development are similar.
(v)	They have similar functions.	They perform different functions.
(vi)	They have dissimilar development pattern.	They have similar development pattern.
(vii)	Analogous organs show convergent evolution.	Homologous organs show adaptive radiation (divergent evolution).
(viii)	Example : wings of insects and wings.	Example : vertebrate forelimbs.