

### Section A

1.
 

**(b)** Intraspecific and interspecific incompatibility

**Explanation:**  
Inbreeding occurs in intraspecific flowers as contain the same kinds of genetic materials. Outbreeding takes place between interspecific flowers having different kinds of genetic materials.
2.
 

**(c)** Trichoderma

**Explanation:**  
Trichoderma
3.
 

**(c)** Parasitism

**Explanation:**  
Parasitism
4.
 

**(d)** dsRNA

**Explanation:**  
dsRNA
5.
 

**(c)** (ii), (iii) and (iv) only

**Explanation:**  
(ii), (iii) and (iv) only
6.
 

**(c)** Capacitation

**Explanation:**  
Capacitation
7.
 

**(b)** *S. cerevisiae*

**Explanation:**  
*S. cerevisiae*
8.
 

**(d)** Released polypeptide chain

**Explanation:**  
The figure shown above represents the translation process in which protein is produced. Ribosome provides the site for protein synthesis and t-RNA brings the amino acids. The 'x' is the polypeptide chain produced.
9.
 

**(b)** Mitosis

**Explanation:**



## Mitosis

10. (c) X-linked recessive transmission  
**Explanation:**  
X-linked recessive transmission
11. (c) 1990  
**Explanation:**  
1990
12. (c)  $4 \rightarrow 3 \rightarrow 2 \rightarrow 1$   
**Explanation:**  
 $4 \rightarrow 3 \rightarrow 2 \rightarrow 1$
13. (b) Both A and R are true but R is not the correct explanation of A.  
**Explanation:**  
The pure line is a strain of genetically pure true-breeding individuals. Members of the pure line are homozygous for one or more characters. In homozygous form both the factors express the same effect. These organisms are said to breed true. They are used for cross breeding in order to get the desired improvement in crops.
14. (b) Both A and R are true but R is not the correct explanation of A.  
**Explanation:**  
Organic compounds that first evolved in earth which required for origin of life were protein and nucleic acid. All life forms were in aquatic environment only.
15. (b) Both A and R are true but R is not the correct explanation of A.  
**Explanation:**  
Polyribosomes attached to membranes of the endoplasmic reticulum produce proteins that either pass into their lumen or become integrated into the membranes. The proteins released into the lumen generally reach Golgi apparatus for modifications like the formation of hydrolytic enzymes and glycosylation (addition of sugar residues). The modified proteins are packed in vesicles for the export or formation of lysosomes, cell wall enzymes, plasma membrane, etc.
16. (c) A is true but R is false.  
**Explanation:**  
A is true but R is false.

## Section B

17. Biogas is a mixture of gases (containing predominantly methane) produced by microbial activity and which may be used as fuel. certain bacteria, which grow anaerobically on cellulosic material, produce large amounts of methane along with  $\text{CO}_2$  and  $\text{H}_2$ . These bacteria are collectively called methanogens and one such common bacterium is Methanobacterium. These bacteria are commonly found in the anaerobic sludge during sewage treatment. These bacteria are also present in the rumen (a part of the stomach) of cattle. A lot of cellulosic material present in the food of cattle is also present in the rumen.
18. a. Shark harvest increases over the years from 1992 to 2003.  
b. Biodiversity decreases due to over exploitation/ excessive harvesting.

19.
  - Simple stirred tank bioreactor.
  - It is used to produce large quantities of products where large volumes (100 - 1000) litres of culture can be processed.
20. A - Testosterone  
B - Spermatogenesis  
C - Sertoli cells  
D - Spermiogenesis
21. Flowers of some plants open or close in response to light and darkness, the phenomenon is called photonasty.  
The movement can be due to changes in turgor or changes in growth (therefore  $K^+$  ion concentration usually controls such movement in plants).

OR

**Ectoparasite:** Parasites that live on the body surface of hosts are called ectoparasites, e.g. leech and ticks.

**Endoparasites:** Parasites that live inside the body of hosts are called endoparasites, e.g. roundworms and hookworms.

### Section C

22. No, dragon flies eat mosquito larva and act as bio control agents. Dragonflies, which eat insects as adults, are a great control on the mosquito population. A single dragonfly can eat 30 to hundreds of mosquitoes per day.
- Values**
- Awareness about environment
  - Critical thinking.
23. i. a. It is the follicular phase, when the endometrium regenerates through proliferation.  
b. Progesterone increases (luteal phase) and maintains the endometrium essential for the implantation of the embryo.  
c. If the ovum is not fertilized, the endometrium disintegrates, leading to menstruation.  
ii. Estrogen is secreted by the follicle cells.  
Progesterone is secreted by the corpus luteum of the ovary.
24. On crossing red and white flower only red colour flower appeared in the  $F_1$  generation. But the white colour flower again appears in the  $F_2$  generation which is raised out of the  $F_1$  individual Mendel reasoned that there is a factor of each and every character. Accordingly, there has to be one factor(R) for red flower and other one factor (r) for white flower. In case, an organism possesses only one copy of the gene then the possibility of reappearance of white flower in the  $F_2$  generation of the given cross is not there. Also, the ratio (3:1 of red and white) indicates that each organism must possess two copies of a particular gene.
25. Latitudinal gradients pattern of biodiversity is observed in the given diagram. The reasons for this type of occurrence are as follows:
- More solar energy available in tropics, more productivity.
  - Tropical environments are less seasonal, so more predictable.
26. **Structure of Pollen grain:**  
Pollen grains are generally spherical and are about 25-50 micrometers in diameter. It has an outer layer exine and inner layer intine. Mature pollen grain contains a bigger vegetative cell and a smaller generative cell.

**Germination of Pollen Grain:** The process of development of pollen tube is called germination. Hydration of stigma results in elongation of tube cells into the pollen tube. Pollen tube then grows towards the ovule for further process.

OR

Parthenocarpy is the condition in which fruits develop without seeds, while apomixis is a condition in which seeds develop without fertilization. Fertilization is absent in both the case but seeds are present in apomixis only. Benefits of Parthenocarpy: Seedless fruits are easier to consume; especially those fruits that naturally contain too many seeds, e.g. papaya, watermelon, and banana.

**Benefits of Apomixis:** Apomixis can be used to produce apomicts hybrid seeds so that farmers will not need to buy hybrid seeds every year. This will help in drastically cutting the cost for farmers.

27. Grazing food chain (GFC) starts with producers that trap solar energy through photosynthesis and feeds the energy into the food chain while detritus food chain (DFC) begins with dead organic matter and their decomposers. Decomposers meet their energy and nutrient requirement by degrading the detritus. A much larger fraction of energy flows through DFC in a terrestrial ecosystem. DFC may be connected with GFC at some levels because some of the organisms of DFC are prey to GFC animals. This natural interconnection of the food chains makes it a complex food web.
28. The function of the ovum and sperm is done outside the woman's body to form a zygote under stimulated conditions in the laboratory. The zygote is then allowed to divide to form embryo. The embryo is then implanted in uterus where it develops into a

foetus, which in turn develops into a child. A baby produced by this technique is called test tube baby.

#### Section D

29. i. Regulation of gene expression can be exerted at four levels : transcriptional level during formation of primary transcript, processing like splicing, terminal additions or modifications, transport of mRNAs from nucleus to the cytoplasm and translational level.
- ii. Only the structural genes of an operon are transcribed into mRNA molecule. Structural gene is a region of DNA that codes for a protein or RNA molecule that forms part of a structure or has an enzymatic function. In the case of lac operon, the structural genes are lac Z, lac Y, lac A which codes for  $\beta$ -galactosidase, lac permease and  $\beta$ -galactoside transacetylase respectively.
- iii. The lac operon consists of:
- Promoter:** binding site of RNA polymerase
- Operator:** binding site of the lac repressor protein
- CAP Binding Site:** binding site of catabolite activator protein.
- 3 structural genes:** lac Z, lac Y and lac A. When lac repressor protein is synthesised in its active conformation, it binds to the operator and the operon is switched off, so there is no transcription.

**OR**

The function of catabolic activator protein in lac operon is to activates lac gene when glucose is absent.

30. i. • Species A  
• The leaf area damaged by species - A in Bt-corn is the least.
- ii. Species-B
- iii. Not to grow Bt variety as seeds are expensive and of not much benefit (productivity wise)/advise to grow Bt corn with its proper justification.

**OR**

Cry IAb

#### Section E

31. i. (a) - Stabilizing, (b) - Directional and (c) - Disruptive selection.
- ii. Peppered moths.
- iii. Following are the factors affecting the Hardy-Weinberg Equilibrium
- Gene migration or gene flow
  - Genetic drift
  - Mutation
  - Genetic recombination
  - Natural selection

The accumulation of differences that can lead to formation of new species is called divergent evolution. When two groups of the same species face isolation from each other, group adapts to the changed circumstances in its own way. Natural selection and adaptation result in formation of adaptations in a particular group. These variations accumulate over various generations and finally a new species comes into origin. Homologous organs are results of divergent evolution. We know that organs which are similar in basic design but serve different purposes in different organisms are called homologous organs. Forelimbs of mammals and birds are very good examples of divergent evolution. In most of the mammals, the forelimbs are suited for walking, running and for doing various other chores. In birds, the forelimbs are modified into wings as part of flight adaptations in birds. In both organisms; the forelimbs are composed of humerus, radio-ulna, carpals and metacarpals. But they serve different purposes in mammals and birds. Homology indicates towards common ancestry.

32. i. Step (B): Lymphocytes are grown in the culture medium.
- Step (D): Infusion of genetically engineered lymphocytes into patients.
- ii. Adenosine deaminase (ADA) deficiency.
- iii. As genetically engineered lymphocytes are not immortal, the patient requires the periodic infusion of cells.
- iv. If the gene isolated from bone marrow cells producing ADA is introduced into cells at early embryonic stages, it could be a permanent cure.

**OR**

Adenosine Deaminase (ADA) Deficiency is a genetic disorder that results in the impairment of the immune system. There are three main approaches used in its treatment:

- i. Enzyme Replacement Therapy (ERT): This approach involves regular infusion of ADA enzyme into the patient's bloodstream. The exogenous ADA enzyme helps to break down toxic metabolites and restore immune function. ERT requires lifelong administration and can improve immune system function in ADA-deficient individuals. Hematopoietic Stem Cell Transplantation (HSCT): HSCT involves replacing the patient's bone marrow cells with healthy donor cells that carry the correct ADA gene.
- ii. Bone marrow transplant
- iii. Gene Therapy: Gene therapy aims to introduce a functional ADA gene into the patient's cells using viral vectors or other delivery methods. The corrected gene helps the patient's cells produce ADA enzyme, leading to improved immune function. Gene therapy holds promise as a potentially curative treatment, but further research and clinical trials are ongoing to ensure its safety and long-term effectiveness.

33. There are many factors which motivate youngsters to take to alcohol or drugs such as

- i. Pleasure or for fun sake
- ii. Curiosity
- iii. Desire to do more work
- iv. The gesture of defiance to elders, partners and friends
- v. Social pressure
- vi. Feeling of independence
- vii. Liking of taste
- viii. Desire for excitement
- ix. Desire to escape from such realities of life as disappointments, frustrations and failures
- x. Unhappy married life and
- xi. Desire to offset the effect of hardships and monotonous daily life.

All the victims of alcohol/drug abuse are sick persons. They need the attention of family members and friends to give up the habit. This is possible under proper medical supervision.

- i. The physician should prescribe the habituating drugs only to a genuine person.
- ii. Pharmacists should not sell these drugs without a physician's prescription.
- iii. Parents should keep a watch on children and should check them from using drugs as soon as they find signs of addiction in them.
- iv. Social workers/policemen, if they find a drug abuser should inform the parents or de-addiction centre.
- v. The addict may have psychological problems at home, at work or with society. The help of family members, social workers and employers may be taken in this work.
- vi. Attempts should be made to help the alcoholics achieve and maintain a high level of motivation towards abstinence.

— THINK BEYOND LIMITS. —

- i. The demand of the residents in the colony, to make the person suffering from AIDS to leave the colony for the fear of the spread of disease is totally wrong, unjustified, unscientific based on wrong beliefs. The AIDS does not spread by physical contact; shaking hands; coughing and sneezing; kissing and embracing; sharing utilities and telephone; swimming pools and toilets, sharing towels, etc.

ii. Preventive measures include-

- a. avoid multiple sexual partners
- b. use of disposable needles and syringes
- c. Avoid tattoos, ear and nose pierces from unqualified people,
- d. The blood test must be done during transfusion and organ transplantation,
- e. The dentist should use sterilised equipment,
- f. Above all people should be educated about AIDS, by NACO and NGOs.
- g. Promoting regular check-up or HIV in a susceptible population.

- iii. Cause: HIV-Human Immunodeficiency Virus (a type of retrovirus with RNA genome).  
Symptoms: Fever, lethargy, pharyngitis nausea, headache, rashes, etc.