# Previous Year Paper

## 30th May 2023 (Shift 1)

**Q1.** Which one of the following is NOT a correct feature of *Home erectus*?
(a) they had large brain around 900 cc.
(b) their fossils were discovered in Java in 1891.
(c) they used hides to protect their body and bury their dead.
(d) they lived about 1.5 million years ago.

**Q2.** While developing purelines, increased homozygosity results in _____.
(a) production of superior male only
(b) aggregation of harmful recessive genes
(c) accumulation of superior genes
(d) increased fertility

**Q3.** In rotifers and honey bees, the formation of new organism takes place without fertilization. This phenomenon is called _____.
(a) apomixis
(b) parthenocarpy
(c) parthenogenesis
(d) embryogenesis

**Q4.** Which of the following is a bacterial disease?
(a) Small pox
(b) Typhoid
(c) Measles
(d) Polio

**Q5.** The hormone which acts on the uterine muscle and causes stronger uterine contractions is known as:
(a) Testosterone
(b) Progesterone
(c) FSH
(d) Oxytocin

**Q6.** Select the incorrect statement/s from the following -
(A) In human male, the testes are situated outside the abdominal cavity within a pouch.
(B) Primary spermatocytes undergo mitosis to form secondary spermatocytes.
(C) Sertoli cells provide nutrition to the germ cells.
(D) Seminal plasma is rich in glucose, calcium and certain enzymes.

Choose the **correct** answer from the options given below:
(a) (B) only
(b) (B) and (C) Only
(c) (B) and (D) only
(d) (A) and (B) only

**Q7.** Which Of the following statements are **incorrect**?
(A) In bacteria, Bt toxin exists as inactive protoxin
(B) Due to alkaline pH in the gut, the toxin is converted into its active form
(C) The toxin is already present in active form in bacteria
(D) The inactive toxin binds to the surface of midgut and causes cell swelling and lysis.

Choose the **correct** answer from the options given below:
(a) (A) and (D) Only
(b) (B) and (C) only
(c) (A) and (B) Only
(d) (C) and (D) only

**Q8.** The process of copying the genetic information from one strand of DNA to RNA is termed as:
(a) Translation
(b) Transcription
(c) Transportation
(d) Transition

**Q9.** Match **List-I** with **List-II**:

| List-I | | List-II | |
|---|---|---|---|
| (A) | Australian marsupials | (I) | Homologous organs |
| (B) | Wings of butterfly and wings of a bird | (II) | Natural selection |
| (C) | Industrial melanism | (III) | Adaptive radiation |
| (D) | Forelimbs of Horse and Bat | (IV) | Analogous organs |

Choose the **correct** answer from the options given below:
(a) (A)-(I), (B)-(II), (C)-(IV), (D)-(III)
(b) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)
(c) (A)-(II), (B)-(I), (C)-(III), (D)-(IV)
(d) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)

**Q10.** Embryological support for evolution was disapproved by _____.
(a) Alexander Von Humboldt
(b) Paul Ehrlich
(c) Karl Ernst Von Baer
(d) Hugo deVries

**Q11.** The sickle cell anaemia is a
(a) Sex linked recessive disease
(b) Autosomal recessive disease
(c) Sex linked dominant disease
(d) Autosomal dominant disease

**Q12.** The presence of additional copy of X chromosome in humans lead to
(a) Down's Syndrome
(b) Klinefelter's Syndrome
(c) Turner's Syndrome
(d) Thalassemia

**Q13.** The mass of living organisms at a particular time at each trophic level is called _____.
(a) Carrying capacity
(b) Standing state
(c) Standing crop
(d) Gross primary productivity

**Q14.** Match **List-I** with **List-II**:

| List-I | | List-II | |
|---|---|---|---|
| (A) | Sea anemone and the clown fish | (I) | *Competition* |
| (B) | Tiger and the deer | (II) | *Predation* |
| (C) | Flamingoes and resident fishes in south American lakes | (III) | *Commensalism* |
| (D) | Mycorrhizae | (IV) | *Amensalism* |
| | | (V) | *Mutualism* |

Choose the **correct** answer from the options given below:
(a) (A)-(III), (B)-(II), (C)-(I), (D)-(V)
(b) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)
(c) (A)-(IV), (B)-(II), (C)-(I), (D)-(III)
(d) (A)-(V), (B)-(II), (C)-(III), (D)-(I)

**Q15.** Which of the following is a hormone releasing IUD?
(a) CuT
(b) Cu7
(c) LNG-20
(d) Multiload 375

**Q16.** Select the correct statement/ s about sporopollenin found in pollen grain.
(A) The hard outer layer of pollen grains is made up of sporopollenin.
(B) It is one of the most resistant organic materials known.
(C) It does not withstand high temperature and strong acids.
(D) No enzyme can degrade it.

Choose the **correct** answer from the options given below:
(a) (A) and (B) only
(b) (A), (B) and (D) only
(c) (C) only
(d) (A), (B) and (C) only

**Q17.** The ability of some snails and fish to avoid summer related problems like heat and dessication is called _____.
(a) Hibernation
(b) Aestivation
(c) Diapause
(d) Migration

**Q18.** Which of the following is a type of 'in-situ' conservation approach?
(a) Zoological Parks
(b) Botanical Gardens
(c) Sacred Groves
(d) Wildlife Safari Parks

**Q19.** Among vertebrates, the maximum number of species belong to _____.
(a) Amphibians
(b) Reptiles
(c) Fishes
(d) Birds

**Q20.** Identify the correct statement about decomposition -
(A) The rate of decomposition is quicker, if detritus is rich in nitrogen and sugar.
(B) Decomposition is largely an oxygen requiring process.
(C) The rate of decomposition is slow, if detritus is rich in chitin and lignin.
(D) The rate of decomposition is slow, if detritus is rich in nitrogen and sugar.

Choose the **correct** answer from the options given below:
(a) (A) and (B) only
(b) (B) only
(c) (C) and (D) only
(d) (A), (B) and (C) only

**Q21.** Arrange the following steps involved in Recombinant DNA Technology in correct sequence.
(A) Insertion of recombinant DNA into host cell/ organism
(B) Cutting of source DNA as well as vector DNA at specific location and their joining
(C) Isolation of the genetic material (DNA)
(D) Obtaining the foreign gene product
(E) Culturing transformed host cells at large scale

Choose the **correct** answer from the options given below:
(a) (C), (B), (A), (E), (D)
(b) (E), (A), (C), (D), (B)
(c) (C), (A), (D), (E), (B)
(d) (D), (B), (A), (C), (E)

**Q22.** Which of the following animal shows oestrus cycle?
(a) Monkey
(b) Ape
(c) Human
(d) Dog

**Q23.** *Taq* polymerase is isolated from:
(a) *Bacillus thuringiensis*
(b) *Thermus aquaticus*
(c) *Staphylococcus*
(d) *Azotobacter*

**Q24.** Match **List-I** with **List-II**:

| List-I | | List-II | |
|---|---|---|---|
| (A) | Physical barriers | (I) | Acid in stomach, saliva in mouth and tears in eyes |
| (B) | Cytokine barriers | (II) | PMNL-neutrophils and monocytes |
| (C) | Cellular barriers | (III) | Skin on body, mucus coating of epithelium which lines respiratory tract |
| (D) | Physiological barriers | (IV) | Interferons |

Choose the **correct** answer from the options given below:
(a) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)
(b) (A)-(I), (B)-(III), (C)-(II), (D)-(IV)
(c) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)
(d) (A)-(II), (B)-(III), (C)-(I), (D)-(IV)

**Q25.** Which of the following is a free-living soil nitrogen fixing bacteria?
(a) *Rhizobium*
(b) *Glomus*
(c) *Azospirillum*
(d) *Oscillatoria*

**Q26.** Match **List-I** with **List-II**:

| List-I | | List-II | |
|---|---|---|---|
| (A) | Wheat | (I) | *Pusa komal* |
| (B) | *Brassica* | (II) | *Himgiri* |
| (C) | Cowpea | (III) | *Pusa sadabahar* |
| (D) | Chilli | (IV) | *Pusa swarnim* |

Choose the **correct** answer from the options given below:
(a) (A)-(II), (B)-(IV), (C)-(I), (D)-(III)
(b) (A)-(II), (B)-(I), (C)-(III), (D)-(IV)
(c) (A)-(I), (B)-(III), (C)-(II), (D)-(IV)
(d) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)

**Q27.** Continued inbreeding and especially close inbreeding reduces fertility and productivity in animals.
This happens due to
(a) Homozygosity
(b) Inbreeding depression
(c) Interspecific depression
(d) Outbreeding depression

**Q28.** Which part of human eye absorbs UV-B radiation?
(a) Iris
(b) Cornea
(c) Retina
(d) Choroid

**Q29.** Steps of replication of retrovirus (HIV) in the host cell are given below. Arrange the steps in correct sequence.
(A) Viral RNA is introduced in host cell
(B) New viruses with new RNA are produced
(C) Viral DNA is produced by reverse transcription
(D) Viral DN A incorporates into host genome
(E) Virus infects the normal cell

Choose the **correct** answer from the options given below:
(a) (E), (A), (C), (D), (B)
(b) (A), (C), (B), (D), (E)
(c) (C), (B), (D), (E), (A)
(d) (B), (D), (A), (C), (E)

**Q30.** Match **List-I** with **List-II**:

| List-I (Name of microorganism) | | List-II (Chemical) | |
|---|---|---|---|
| (A) | *Aspergillus niger* | (I) | Citric acid |
| (B) | *Acetobacter aceti* | (II) | Acetic acid |
| (C) | *Clostridium butylicum* | (III) | Butyric acid |
| (D) | *Lactobacillus* | (IV) | Lactic acid |

Choose the **correct** answer from the options given below:
(a) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)
(b) (A)-(II), (B)-(I), (C)-(III), (D)-(IV)
(c) (A)-(I), (B)-(II), (C)-(IV), (D)-(III)
(d) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)

**Q31.** Arrange the following steps involved in Frederick Griffith experiment in correct order.
(A) When R-strain was injected into mice, the mice remained alive.
(B) When heat killed S-strain was injected into mice, the mice remained alive.
(C) The *Streptococcus pneumoniae* bacteria grown on a culture plate to produce the S and R strain colonies.
(D) When S-strain was injected into mice, the mice died.
(E) When heat killed S-strain + live R-strain was injected into mice, the mice died.

Choose the **correct** answer from the options given below:
(a) (A), (D), (B), (C), (E)
(b) (C), (D), (A), (B), (E)
(c) (D), (B), (C), (E), (A)
(d) (C), (A), (D), (B), (E)

**Q32.** RNAi takes place in all eukaryotic organisms as a method of _____.
(a) transcription of functional RNA
(b) protein synthesis
(c) cellular defense
(d) translation of functional protein

**Q33.** Which of the following is NOT a sexually transmitted disease?
(a) Trichomoniasis
(b) Syphilis
(c) Cirrhosis
(d) Chlamydiasis

**Q34.** Match **List-I** with **List-II**:

| List-I | | List-II | |
|---|---|---|---|
| (A) | Streptokinase | (I) | immuno suppressive agent |
| (B) | Cyclosporin A | (II) | clot buster |
| (C) | Statin | (III) | helpful in removing oil stains |
| (D) | Lipase | (IV) | blood cholesterol lowering agents |

Choose the **correct** answer from the options given below:
(a) (A)-(II), (B)-(IV), (C)-(III), (D)-(I)
(b) (A)-(IV), (B)-(I), (C)-(III), (D)-(II)
(c) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)
(d) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)

**Q35.** Select the correct statements with respect to *Agrobacterium tumefaciens.*
(A) It is a pathogen of many monocot plants.
(B) It can deliver T-DNA and transform normal plant cells into tumor
(C) Tumor inducing plasmid of Agrobacterium tumefaciens is modified into a pathogenic cloning vector.
(D) Tumor inducing plasmid of Agrobacterium tumefaciens is used to deliver genes of interest into plants

Choose the **correct** answer from the options given below:
(a) (A), (B) and (D) only
(b) (B) and (D) only
(c) (A), (B) and (C) only
(d) (B), (C) and (D) only

**Q36.** According to the Central Pollution Control Board (CPCB), the particulate size responsible for causing the greatest harm to human health is:
(a) PM 2.5
(b) PM 5.2
(c) PM 4.0
(d) PM 4.5

**Q37.** Which of the following came to India as a contaminant with imported wheat _____.
(a) *Oxalis*
(b) *Parthenium*
(c) *Hibiscus*
(d) *Zostera*

**Q38.** Which vector is used for introducing nematode specific genes into the tobacco host plant.
(a) Bacteriophage
(b) *Agrobacterium*
(c) Plasmid
(d) *Bacillus thuringiensis*

**Q39.** Which of the following show Pleiotropism?
(a) Thalassemia
(b) Phenylketonuria
(c) Haemophilia
(d) Anaemia

**Q40.** Match **List-I** with **List-II**:

| List-I | | List-II | |
|---|---|---|---|
| (A) | Operator | (I) | RNA polymerase |
| (B) | Promotor | (II) | Permeability of the cell |
| (C) | *y*-gene | (III) | Hydrolysis of a specific disaccharide |
| (D) | *z*-gene | (IV) | Repressor protein |

Choose the **correct** answer from the options given below:
(a) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)
(b) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)
(c) (A)-(IV), (B)-(III), (C)-(II), (D)-(I)
(d) (A)-(III), (B)-(IV), (C)-(I), (D)-(II)

Direction for the question 41 to 45: **Read the paragraph given below and answer the question.**
Sutton and Boveri argued that the pairing and separation of a pair of chromosomes would lead to the segregation of a pair of factors they carried. Sutton united the knowledge of chromosomal segregation with Mendelian principles and called it the **chromosomal theory of inheritance**.
Following this synthesis of ideas, experimental verification of the chromosomal theory of inheritance by Thomas Hunt Morgan and his colleagues, led to discovering the basis for the variation that sexual reproduction produced. Morgan worked with the tiny fruit files, which were found very suitable for such studies. They could be grown on simple synthetic medium in the laboratory. They complete their life cycle in a short Span of time and a single mating could produce a large number of progeny flies. Also, there was a clear differentiation of the sexes - the male and female flies are easily distinguishable. Also, it has many types of hereditary variations that can be seen with low power microscopes.

**Q41.** The scientist who noted that "The behaviour of chromosomes was parallel to the behaviour of gene" were:
(a) Sutton and Boveri
(b) de Vries, Correns and Tschermak
(c) Punnet and Bateson
(d) Morgan and Bridges

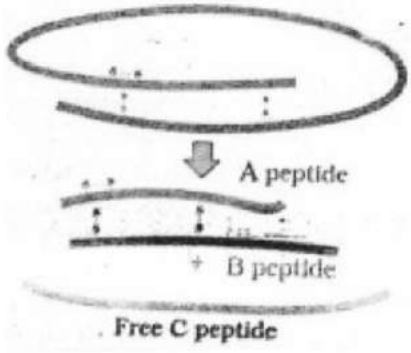
**Q42.** Which of the following scientist worked with *Drosophila*?
(a) Walter Sutton and Theodore Boveri
(b) Frederick Griffith
(c) Thomas Hunt Morgan
(d) Correns

**Q43.** *Drosophila melanogaster* complete their life cycle in
(a) about 1 week
(b) about 2 weeks
(c) about 3 to 4 weeks
(d) about 7 weeks

**Q44.** Which statement is incorrect with respect to *Drosophila*.
(a) Could be easily grown in laboratory
(b) Easily distinguishable male and female
(c) Large number of contrasting traits
(d) Less number of variations in their population helps in better studying of traits

**Q45.** Cross performed between yellow bodied, white eyed females and brown bodied red eyed males of *Drosophila* results in:
(a) 9 : 3 : 3 : 1 $F_2$ ratio
(b) 1: 2 : 1 $F_1$ ratio
(c) $F_2$ ratio deviating from 9 : 3 : 3 : 1
(d) $F_1$ ratio deviating from 1 : 2 : 1

Direction for the question 46 to 50: **Read the paragraph given below and answer the question.**
Insulin used for diabetes was earlier extracted from slaughtered cattle and pigs. Insulin from an animal source, though caused some patients to develop allergy or other type of reactions. Insulin consists of two short polypeptide chains: chain A and chain B, that are linked bridges. In mammals, including human, insulin is synthesised as a pro-hormone.




**Q46.** Proinsulin is made up:
(A) Peptide A
(B) Free peptide
(C) Peptide B
(D) Peptide C

Choose the **correct** answer from the options given below:
(a) (A), (C), (D) only
(b) (A), (B), (D) only
(c) (B), (C), (D) only
(d) (A), (B), (C) only

**Q47.** Insulin is synthesised as _____ in mammals.
(a) Pro-hormone
(b) Pro-enzyme
(c) Peptide C
(d) Disulfide bond

**Q48.** Bonds which link 'A' and 'B' peptide chains of human insulin are _____.
(a) Peptide
(b) Disulfide
(c) Covalent
(d) Hydrogen

**Q49.** Identify the correct statements.
(A) Insulin was earlier extracted from the liver of slaughtered animals.
(B) Eli Lilly, an American company is producing insulin using r-DNA technique.
(C) Some diabetics developed allergy with the animal sourced insulin.
(D) Pro-insulin can control diabetes.

Choose the **correct** answer from the options given below:
(a) (A) and (B) only
(b) (B) and (D) only
(c) (B) and (C) only
(d) (A) and (D) only

**Q50.** Patient with diabetes have:
(a) Normal blood glucose level
(b) Normal glucose and electrolyte level in blood
(c) Blood glucose level less than normal level
(d) Blood glucose more than normal level

## SOLUTIONS

**S1. Ans. (c)**
**Sol.** Fossils discovered in Java in 1891 revealed the next stage, i.e., Homo erectus about 1.5 mya. Homo erectus had a large brain around 900cc. Homo erectus probably ate meat.

**S2. Ans. (c)**
**Sol.** Inbreeding increases homozygosity. Thus, inbreeding is necessary if we want to evolve a pureline in any animal. Inbreeding exposes harmful recessive genes that are eliminated by selection. It also helps in accumulation of superior genes and elimination of less desirable genes

**S3. Ans. (c)**
**Sol.** In rotifers, honeybees and even some lizards and birds (turkey), the female gamete undergoes development to form new organisms without fertilisation. This phenomenon is called parthenogenesis.

**S4. Ans. (b)**
**Sol.** *Salmonella typhi* is a pathogenic bacterium which causes typhoid fever in human beings. These pathogens generally enter the small intestine through food and water contaminated with them and migrate to other organs through blood. Sustained high fever (39° to 40°C), weakness, stomach pain, constipation, headache and loss of appetite are some of the common symptoms of this disease.

**S5. Ans. (d)**
**Sol.** Oxytocin acts on the uterine muscle and causes stronger uterine contractions, which in turn stimulates further secretion of oxytocin. The stimulatory reflex between the uterine contraction and oxytocin secretion continues resulting in stronger and stronger contractions that leads to expulsion of the baby out of the uterus through the birth canal – parturition.

**S6. Ans. (c)**
**Sol.** In testis, the immature male germ cells (spermatogonia) produce sperms by spermatogenesis that begins at puberty. The spermatogonia present on the inside wall of seminiferous tubules multiply by mitotic division and increase in numbers. Each spermatogonium is diploid and contains 46 chromosomes. Some of the spermatogonia called primary spermatocytes periodically undergo meiosis. A primary spermatocyte completes the first meiotic division (reduction division) leading to formation of two equal, haploid cells called secondary spermatocytes. The male accessory glands include paired seminal vesicles, a prostate and paired bulbourethral glands. Secretions of these glands constitute the seminal plasma which is rich in fructose, calcium and certain enzymes.

**S7. Ans. (d)**
**Sol.** *B. thuringiensis* forms protein crystals during a particular phase of their growth. These crystals contain a toxic insecticidal protein. Actually, the Bt toxin protein exist as inactive protoxins but once an insect ingest the inactive toxin, it is converted into an active form of toxin due to the alkaline pH of the gut which solubilise the crystals. The activated toxin binds to the surface of midgut epithelial cells and create pores that cause cell swelling and lysis and eventually cause death of the insect.

**S8. Ans. (b)**
**Sol.** The process of copying genetic information from one strand of DNA into RNA is termed transcription.

**S9. Ans. (b)**
**Sol.** whales, bats, Cheetah and human (all mammals) share similarities in the pattern of bones of forelimbs. Though these forelimbs perform different functions in these animals, they have similar anatomical structure. This is divergent evolution and these structures are homologous. Wings of butterfly and of birds look alike. They are not anatomically similar structures though they perform similar functions. Hence, analogous structures are a result of convergent evolution. Another interesting observation supporting evolution by natural selection is industrial melanism. Australian marsupials is an example of adaptive radiation.

**S10. Ans. (c)**
**Sol.** Embryological support for evolution was also proposed by Ernst Heckel based upon the observation of certain features during embryonic stage common to all vertebrates that are absent in adult. However, this proposal was disapproved on careful study performed by Karl Ernst von Baer.

**S11. Ans. (b)**
**Sol.** Sickle-cell anaemia is an autosome linked recessive trait that can be transmitted from parents to the offspring when both the partners are carrier for the gene (or heterozygous).

**S12. Ans. (b)**
**Sol.** Klinefelter's Syndrome is caused due to the presence of an additional copy of X-chromosome resulting into a karyotype of 47, XXY.

**S13. Ans. (c)**
**Sol.** Each trophic level has a certain mass of living material at a particular time called as the standing crop. The standing crop is measured as the mass of living organisms (biomass) or the number in a unit area.

**S14. Ans. (a)**
**Sol.** Example of commensalism is the interaction between sea anemone that has stinging tentacles and the clown fish that lives among them. In some shallow South American lakes, visiting flamingoes and resident fishes compete for their common food, the zooplankton in the lake, is an example of competition. The mycorrhizae are associations between fungi and the roots of higher plants. The fungi help the plant in the absorption of essential nutrients from the soil while the plant in turn provides the fungi with energy-yielding carbohydrates. It is an example of mutualism.

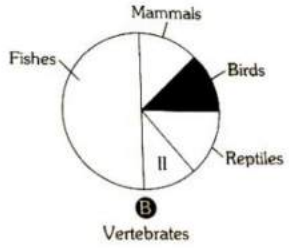
**S15. Ans. (c)**
**Sol.** LNG-20 is a hormone releasing IUD.

**S16. Ans. (b)**
**Sol.** The hard outer layer called the exine is made up of sporopollenin which is one of the most resistant organic material known. It can withstand high temperatures and strong acids and alkali. No enzyme that degrades sporopollenin is so far known.

**S17. Ans. (b)**
**Sol.** Some snails and fish go into aestivation to avoid summer–related problems-heat and dessication.

**S18. Ans. (c)**
**Sol.** Sacred Groves is an in-situ conservation approach. Sacred groves are found in Khasi and Jaintia Hills in Meghalaya, Aravalli Hills of Rajasthan, Western Ghat regions of Karnataka and Maharashtra and the Sarguja, Chanda and Bastar areas of Madhya Pradesh.

**S19. Ans. (c)**
**Sol.**




**S20. Ans. (d)**
**Sol.** Decomposition is largely an oxygen-requiring process. The rate of decomposition is controlled by chemical composition of detritus and climatic factors. In a particular climatic condition, decomposition rate is slower if detritus is rich in lignin and chitin, and quicker, if detritus is rich in nitrogen and water-soluble substances like sugars.

**S21. Ans. (a)**
**Sol.** Recombinant DNA technology involves several steps in specific sequence such as isolation of DNA, fragmentation of DNA by restriction endonucleases, isolation of a desired DNA fragment, ligation of the DNA fragment into a vector, transferring the recombinant DNA into the host, culturing the host cells in a medium at large scale and extraction of the desired product.

**S22. Ans. (d)**
**Sol.** In non-primate mammals like cows, sheep, rats, deers, dogs, tiger, etc., such cyclical changes during reproduction are called oestrus cycle where as in primates (monkeys, apes, and humans) it is called menstrual cycle.

**S23. Ans. (b)**
**Sol.** Repeated amplification during PCR is achieved by the use of a thermostable DNA polymerase (isolated from a bacterium, *Thermus aquaticus*), which remain active during the high temperature induced denaturation of double stranded DNA.

**S24. Ans. (c)**
**Sol.** Physical barriers is skin on our body is the main barrier which prevents entry of the micro-organisms. Mucus coating of the epithelium lining the respiratory, gastrointestinal and urogenital tracts also help in trapping microbes entering our body. Physiological barrier is acid in the stomach, saliva in the mouth, tears from eyes–all prevent microbial growth. Cellular barriers are certain types of leukocytes (WBC) of our body like polymorpho-nuclear leukocytes (PMNL-neutrophils) and monocytes and natural killer (type of lymphocytes) in the blood as well as macrophages in tissues can phagocytose and destroy microbes. Cytokine barriers, the virus-infected cells secrete proteins called interferons which protect non-infected cells from further viral infection.

**S25. Ans. (c)**
**Sol.** Other bacteria can fix atmospheric nitrogen while free-living in the soil (examples Azospirillum and Azotobacter), thus enriching the nitrogen content of the soil

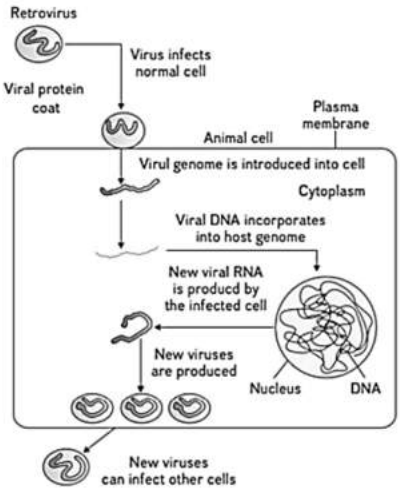
**S26. Ans. (a)**
**Sol.**

| Crop | Variety | Resistance to diseases |
|---|---|---|
| *Wheat* | *Himgiri* | *Leaf and stripe rust, hill bunt* |
| *Brassica* | *Pusa swarnim (Karan rai)* | *White rust* |
| *Cauliflower* | *Pusa Shubhra, Pusa Snowball K-1* | *Black rot and Curl blight black rot* |
| *Cowpea* | *Pusa Komal* | *Bacterial blight* |
| *Chilli* | *Pusa Sadabahar* | *Chilly mosaic virus, Tobacco mosaic virus and Leaf curl* |

**S27. Ans. (b)**
**Sol.** continued inbreeding, especially close inbreeding, usually reduces fertility and even productivity. This is called inbreeding depression.

**S28. Ans. (b)**
**Sol.** In human eye, cornea absorbs UV-B radiation, and a high dose of UV-B causes inflammation of cornea, called snow-blindness, cataract, etc. Such exposure may permanently damage the cornea.

**S29. Ans. (a)**
**Sol.**




**S30. Ans. (a)**
**Sol.** Examples of acid producers are Aspergillus niger (a fungus) of citric acid, Acetobacter aceti (a bacterium) of acetic acid; Clostridium butylicum (a bacterium) of butyric acid and Lactobacillus (a bacterium) of lactic acid.

**S31. Ans. (b)**
**Sol.** In 1928, Frederick Griffith, in a series of experiments with Streptococcus pneumoniae (bacterium responsible for pneumonia), witnessed a miraculous transformation in the bacteria. When Streptococcus pneumoniae (pneumococcus) bacteria are grown on a culture plate, some produce smooth shiny colonies (S) while others produce rough colonies (R). This is because the S strain bacteria have a mucous (polysaccharide) coat, while R strain does not. Mice infected with the S strain (virulent) die from pneumonia infection but mice infected with the R strain do not develop pneumonia. Griffith was able to kill bacteria by heating them. He observed that heat-killed S strain bacteria injected into mice did not kill them. When he injected a mixture of heat-killed S and live R bacteria, the mice died. Moreover, he recovered living S bacteria from the dead mice. He concluded that the R strain bacteria had somehow been transformed by the heat-killed S strain bacteria. Some 'transforming principle', transferred from the heat-killed S strain, had enabled the R strain to synthesise a smooth polysaccharide coat and become virulent.

**S32. Ans. (c)**
**Sol.** RNAi takes place in all eukaryotic organisms as a method of cellular defense. This method involves silencing of a specific mRNA due to a complementary dsRNA molecule that binds to and prevents translation of the mRNA (silencing).

**S33. Ans. (c)**
**Sol.** Gonorrhoea, syphilis, genital herpes, chlamydiasis, genital warts, trichomoniasis, hepatitis-B are some of the STDs.

**S34. Ans. (c)**
**Sol.** Streptokinase produced by the bacterium Streptococcus and modified by genetic engineering is used as a 'clot buster' for removing clots from the blood vessels of patients who have undergone myocardial infarction leading to heart attack. Cyclosporin A, that is used as an immunosuppressive agent in organ-transplant patients, is produced by the fungus Trichoderma polysporum. Statins produced by the yeast Monascus purpureus have been commercialised as blood-cholesterol lowering agents. Lipases are used in detergent formulations and are helpful in removing oily stains from the laundry.

**S35. Ans. (b)**
**Sol.** Agrobacterium tumifaciens, a pathogen of several dicot plants is able to deliver a piece of DNA known as 'T-DNA' to transform normal plant cells into a tumor and direct these tumor cells to produce the chemicals required by the pathogen. The tumor inducing (Ti) plasmid of Agrobacterium tumifaciens has now been modified into a cloning vector which is no more pathogenic to the plants but is still able to use the mechanisms to deliver genes of our interest into a variety of plants.

**S36. Ans. (a)**
**Sol.** According to Central Pollution Control Board (CPCB), particulate size 2.5 micrometers or less in diameter (PM 2.5) are responsible for causing the greatest harm to human health. These fine particulates can be inhaled deep into the lungs and can cause breathing and respiratory symptoms, irritation, inflammations and damage to the lungs and premature deaths.

**S37. Ans. (b)**
**Sol.** Parthenium or carrot grass came into India as seed containment with wheat.

**S38. Ans. (b)**
**Sol.** Using Agrobacterium vectors, nematode-specific genes were introduced into the host plant.

**S39. Ans. (b)**
**Sol.** When a single gene can exhibit multiple phenotypic expression. Such a gene is called a pleiotropic gene. E.g phenylketonuria

**S40. Ans. (a)**
**Sol.** The z gene codes for beta-galactosidase (β-gal), which is primarily responsible for the hydrolysis of the disaccharide, lactose into its monomeric units, galactose and glucose. The y gene codes for permease, which increases permeability of the cell to β-galactosides. The repressor of the operon is synthesised (all-the-time – constitutively) from the i gene. The repressor protein binds to the operator region of the operon and prevents RNA polymerase from transcribing the operon. In the presence of an inducer, such as lactose or allolactose, the repressor is inactivated by interaction with the inducer. This allows RNA polymerase access to the promoter and transcription proceeds

**S41. Ans. (a)**

**Sol.** Walter Sutton and Theodore Boveri noted that the behaviour of chromosomes was parallel to the behaviour of genes and used chromosome movement to explain Mendel's laws.

**S42. Ans. (c)**

**Sol.** Experimental verification of the chromosomal theory of inheritance by Thomas Hunt Morgan and his colleagues, led to discovering the basis for the variation that sexual reproduction produced. Morgan worked with the tiny fruit flies, Drosophila melanogaster, which were found very suitable for such studies.

**S43. Ans. (b)**

**Sol.** Drosophila completes their life cycle in about two weeks, and a single mating could produce a large number of progeny flies.

**S44. Ans. (d)**

**Sol.** Drosophila melanogaster, which were found very suitable for studies performed by Morgan. They could be grown on simple synthetic medium in the laboratory. They complete their life cycle in about two weeks, and a single mating could produce a large number of progeny flies. Also, there was a clear differentiation of the sexes – the male and female flies are easily distinguishable. Also, it has many types of hereditary variations that can be seen with low power microscopes.

**S45. Ans. (c)**

**Sol.** Morgan carried out several dihybrid crosses in Drosophila to study genes that were sex-linked. The crosses were similar to the dihybrid crosses carried out by Mendel in peas. Morgan hybridised yellow-bodied, white-eyed females to brown-bodied, red-eyed males and intercrossed their F1 progeny. He observed that the two genes did not segregate independently of each other and the F2 ratio deviated very significantly from the 9:3:3:1 ratio.

**S46. Ans. (a)**

**Sol.** Insulin consists of two short polypeptide chains: chain A and chain B, that are linked together by disulphide bridges. In mammals, including humans, insulin is synthesised as a pro-hormone which contains an extra stretch called the C peptide. This C peptide is not present in the mature insulin and is removed during maturation into insulin.

**S47. Ans. (a)**

**Sol.** In mammals, including humans, insulin is synthesised as a pro-hormone.

**S48. Ans. (b)**

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

**S49. Ans. (c)**

**Sol.** Insulin used for diabetes was earlier extracted from pancreas of slaughtered cattle and pigs. Insulin from an animal source caused some patients to develop allergy or other types of reactions to the foreign protein.

**S50. Ans. (d)**

**Sol.** With diabetes, your body doesn't make enough insulin or can't use it. When there isn't enough insulin or cells stop responding to insulin, too much blood sugar stays in your bloodstream. Over time, that can cause serious health problems, such as heart disease.