

CBSE Sample Paper 2

(Issued by Central Board of Secondary Education)

Time : 3 Hours

Max. Marks : 70

General Instructions

- (i) All questions are compulsory.
- (ii) This question paper consists four sections A, B, C and D. Section A contains 8 questions of 1 mark each, section B is of 10 questions of 2 marks each, section C is of 9 question of 3 marks each and section D is of 3 question of 5 marks each.
- (iii) There is no overall choice. However, an internal choice has been provided in one question of 2 marks, one question of 3 marks and all the 3 question of 5 marks weightage. A student has to attempt only one of the the alternatives is such questions.
- (iv) Wherever necessary, the diagrams drawn should be neat and properly labelled.

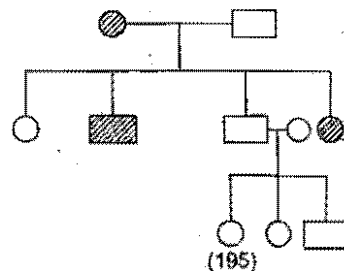
Section A

1. In the whiptail lizards only females are born generation after generation. There are no males. How is this possible?
2. In the following figure of a fruit, label the part which is protective in function and that which is responsible for producing new plants.



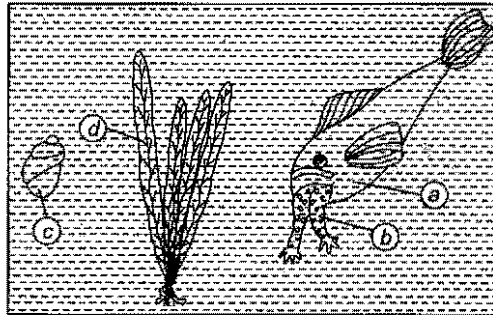
3. Which Mendel's law of inheritance is universally acceptabel and without any exception? State the law.
4. In the following pedigree chart, state if the trait is autosomal dominant, autosomal

recessive or sex linked. Give reason for your answer.



5. Given below are pairs of disease and causative organism. Which out of these is not a matching pair and why?
Filariasis Wuchereria
Ringworm Ascaris
AIDS Human immuno virus
Malaria Plasmodium

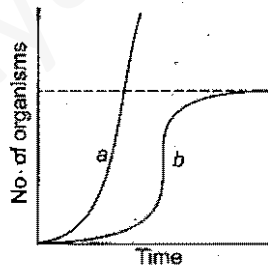
6. In the picture provided, what is the relationship between 'a' and 'b' with respect to population interaction and between 'c' and 'd' with respect to trophic levels.



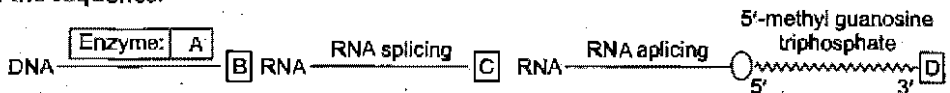
7. Provide one word or one sentence information about 'plasmid' with respect to its (a) chemical nature and (b) its duplication.
 8. Expand the following (a) PCR (b) Bt

Section B

9. In the adjacent population growth curve,
 (a) What is the status of food and space in the curves a and b?
 (b) In the absence of the predators, which curve a and b would appropriately depict the prey population?



10. Given below is a sequence of steps of transcription in a eukaryotic cell. Fill up the blanks (A, B, C, D) left in the sequence.



OR

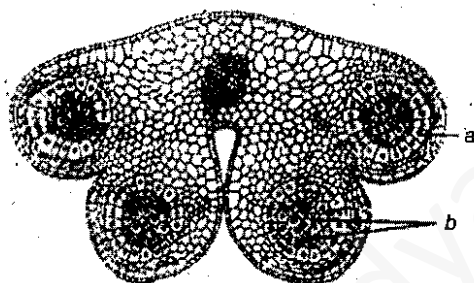
Certain molecular processes are given in column A. Provide the terms given to these processes in column B, after selecting them from the terms. Recombination, gene regulation, prokaryotic, transcription, eukaryotic transcription, translation, replication, gene transfer, DNA fingerprinting.

| Column A | Column B |
|---|----------|
| DNA → | _____ |
| DNA → | _____ |
| mRNA — | _____ |
| Repressor — Operator → No transcription | _____ |

11. In the following table, the ecological units are mentioned in the first column vertically and their attributes are mentioned horizontally. Match the ecological units and its attribute and put a tick in the blanks within the table.

| Attribute: Ecological Units | Age | Flow of Energy | Natality | Predato-prey Relationship |
|--------------------------------|-----|----------------|----------|---------------------------|
| Individual organism | | | | |
| Population | | | | |
| Community | | | | |
| Ecosystem | | | | |

12. In the T.S. of a mature anther given below identify 'a' and 'b' and mention their function.

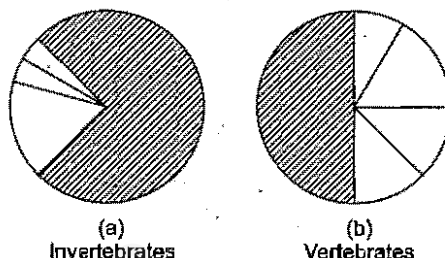


13. In the table given below, select and enter one correct device out of the following: Oral pill, condom, copper-T, saheeli, vasectomy, diaphragm, tubectomy and cervical cap

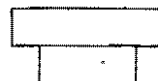
| Method of Birth Control | Device |
|-------------------------|--------|
| Barrier | |
| IUD | |
| Surgical technique | |
| Administering hormones | |

14. If the chromosome number of a plant species is 16, what would be the chromosome number and the ploidy level of the (a) microspore mother cell and (b) the endosperm cells?

15. In the pie charts (a) and (b) drawn below to show the global animal diversity, which groups of animals would you name and write on the areas shaded black in (a) and (b). In which kind of habitat would you find these groups of animals?



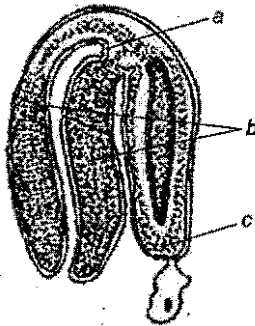
16. In the pyramid of biomass drawn below,
(a) Name the two crops. (i) One which is supported (ii) The one which supports.
(b) In which ecosystem is such a pyramid found?



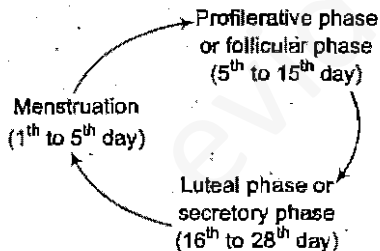
17. The steps in a programme are :
-Collection of germplasm
-Crossbreeding the selected parents
-Selecting superior recombinant progeny
-testing, releasing and marketing new cultivars
(a) What is this programme related to?
(b) name two special qualities as basis of selection of the progeny.
(c) What was the outcome of the programme?
(d) What is the popular term given to this outcome? Also name the Indian scientist who is credited with chalking out of this programme.
18. What is measured in BOD test? BOD level of three samples of water labelled as A, B and C are 30 mg/L, 10 mg/L and 500 mg/L respectively. Which sample of water is most polluted?

Section C

19. How are biofertilizers different from fertilizers such as NPK that we buy in the market? Justify the role of *Rhizobium* as a biofertilizer.
20. In the adjacent figure of a typical dicot embryo, label the parts (a), (b) and (c). State the function of each of the labelled part.



21. The events of the menstrual cycle are represented below. Answer the questions following the diagram



- (a) State the levels of FSH, LH and progesterone simply by mentioning high or low, around 13th and 14th day and 21st to 23rd day.
- (b) In which of the above mentioned phases does the egg travel to the fallopian tube?
- (c) Why is there no menstruation upon fertilization?
22. Few gaps have been left in the following table showing terms and their meanings. Fill in the gaps.

| Terms | Meanings |
|------------------------------|---|
| (a) — | Non-coding sequence in eukaryotic DNA |
| (b) — | Technique used in solving paternity disputes |
| (c) Restriction endonuclease | |
| (d) Plasmid | |
| (e) Transgenics | |
| (f) — | Nucleotide sequences with single base differences |

23. A₃' ————— 5'B
C₅' ————— 3'D

AB and CD represent two strands of a DNA molecule.

When this molecule undergoes replication, forming a replication fork between A and C in the above.

- (a) Name the template strands for replication.
- (b) Using which strand as the template, will there be continuous synthesis of a complementary DNA strand?
- (c) Complementary to which strand will Okazaki segments get synthesized discontinuous synthesis will occur.
- (d) What are template strands and Okazaki pieces?
- (e) In which direction is a new strand synthesized?
24. 'A population has been exhibiting genetic equilibrium'. Answer the following with regard to the above statement
- (a) Explain the above statement.
- (b) Name the underlying principle.
- (c) List any two factors which would upset the genetic equilibrium of the population.
- (d) Take up any one such factor and explain how the gene pool will change due to that factor.

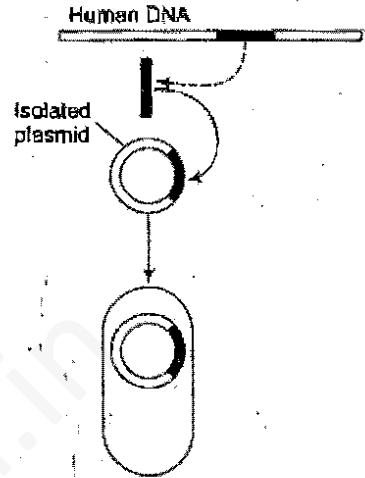
OR

In the 1950s there were hardly any mosquitoes in Delhi. The use of the pesticide DDT on standing water killed their larvae. It is believed that now there are

mosquitoes because they evolved DDT resistance through the interaction of mutation and Natural Selection. Pointwise, state in a sequence how that could have happened.

25. A thalassaemic child needed repeated blood transfusions got infected by HIV.
- Use a rough diagrammatic sketch and arrows to show how the virus increased in number.
 - Why did the increased number of the HIV virus deteriorate the child's immunity?
 - Which diagnostic test showed that the infective virus was HIV?
26. Microbes play a dual role when used for sewage treatment as they not only help to retrieve usable water but also generate fuel. Write in points how this happens?

27. Name the particular technique in biotechnology whose steps are shown in the figure. Use the figure to summarise the technique in three steps.



Section D

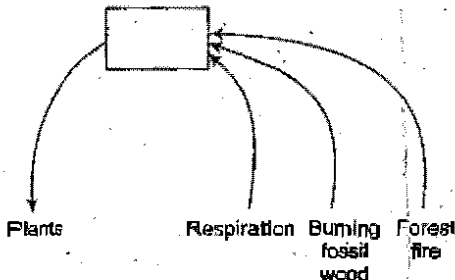
28. With an example, explain how biotechnology has been applied in each of the following :
- In curing diabetes mellitus.
 - In raising pest resistant plants.
 - In producing more nutritionally balanced milk.

Do you think it is ethical to manipulate organisms for human benefits? Justify your answer.

OR

Name any two cloning vectors. Describe the features required to facilitate cloning into a vector.

29.



The above diagram shows a simplified biogeochemical cycle.

- Name the compound whose cycle is depicted.
- In what way do vehicles add this compound to the atmosphere?
- What adverse effect does its excess have on the environment?
- Cite an event which depicts this effect in the modern times.
- Suggest two ways of reducing this effect.

OR

Create an aquatic food chain in a water body into which effluents flow from a pesticide factory. Diagrammatically represent biomagnification in this food chain.

Explain why a decline in the predator bird population is expected, when it feeds on the tertiary consumers of this food chain.

30. (a) Study the following carefully and explain why mutation (A) did not cause any sickle cell anaemia inspite of change in the molecular structure of the

gene which codes for haemoglobin, when as a similar mutation (B) did (the question is based on properties of the genetic code c = codon, a = amino acid, Hb = Haemoglobin).

| | |
|-------------------|--|
| Codons for Hb | C ₁ - C ₂ - C ₃ - C ₄ - C ₅ - GAG - GAA - C ₈ |
| Amino acids in Hb | a ₁ - a ₂ - a ₃ - a ₄ - a ₅ - Glutamic acid - Glutamic acid - a ₈ (Normal haemoglobin) |
| Mutation (A) | C ₁ - C ₂ - C ₃ - C ₄ - C ₅ - GAA - GAA - C ₈ |
| | a ₁ - a ₂ - a ₃ - a ₄ - a ₅ - Glutamic acid - Glutamic acid - a ₈ (Normal haemoglobin) |
| Mutation (B) | C ₁ - C ₂ - C ₃ - C ₄ - C ₅ - GUG - GAA - C ₈ |
| | a ₁ - a ₂ - a ₃ - a ₄ - a ₅ - Valine - Glutamic acid - a ₈ |
| | (Sickle cell haemoglobin) |

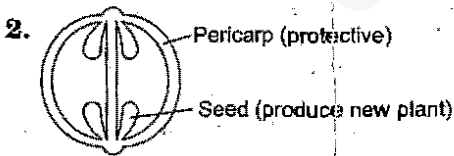
- (b) Why is tRNA referred as 'the adapter molecule'
 (c) In the first phase of translation amino acids are activated in the presence of ATP and linked to their cognate tRNA.
 (i) What is this process called as?
 (ii) Why is it important?

OR

One chromosome contains one molecule of DNA. In eukaryotes, the length of the DNA molecule is enormously large. Explain how such a long molecule fits into the tiny chromosomes seen at metaphase.

Explanations

1. In whiptail lizards, mode of reproduction is asexual reproduction or parthenogenesis. This leads to birth of only females in every generation.



3. The law of segregation. The factors or alleles present in pairs segregate during gamete formation or similarly worded.
 4. Autosomal dominant. Defective trait in both male and female progeny unaffected child did not pass down trait.
 5. Ringworm : *Ascaris*, because ringworm is a disease caused by a fungus (or named fungus) *Ascaris* causes Asc

6. Predator-prey/Predation between level in (a) and (b). Producer-consumer between levels in (c) and (d).

7. (a) **Chemical nature of plasmid** It is made of DNA/Deoxyribonucleic acid.

- (b) **Duplication** It replicates/duplicates along with host bacterial DNA.

8. (a) PCR-Polymerase Chain Reaction,
 (b) *BT-Bacillus thuringiensis*.

9. (a) a-Unlimited food and space, b-Limited food and space.

- (b) Curve a, K/carrying capacity.

10. A -- RNA polymerase

B -- hn

C -- m

D -- Poly A-tail

OR

Replication, eukaryotic transcription,
 translation, gene regulation.

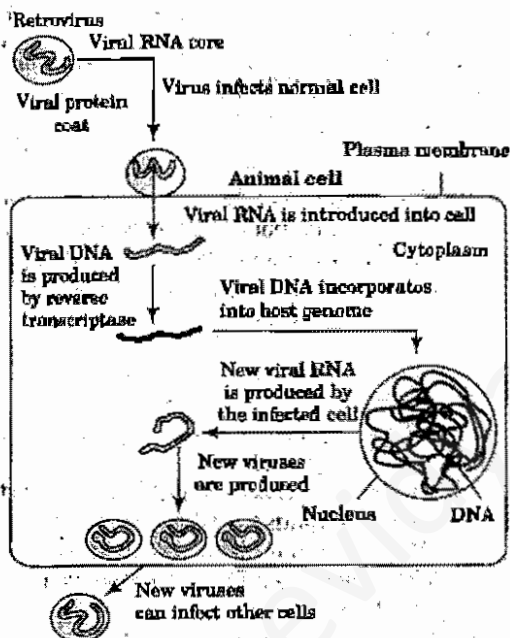
11. Individual = age, Population = Natality, Community = predator-prey relation, Ecosystem = energy flow.
12. 'a'—Sporogenous tissue. It forms microspores or pollen grains.
'b'—Tapetum. It nourishes the developing pollen grains.
13. Barrier = Diaphragm/condom/cervical cap IUD = Copper-T
Surgical technique = Vasectomy/tubectomy
Hormonal administrations = Oral pill/saheli
14. (a) Microspore mother cell = 16, Ploidy diploid/2n
(b) Endosperm cell = Triploid ploidy in 3n
15. (a) Insects/arthropods. These are found in aerial/air/ground/soil/water habitats.
(b) Fishes/pisces, these are found in aquatic/water/sea/river, etc., habitats.
16. (a) (i) Zooplanktons (ii) Phytoplanktons
(b) Aquatic/water ecosystem shows pyramid of biomass.
17. (a) Plant breeding
(b) High yield and pest resistant/drought resistant, etc., (any two)
(c) For increase in food production
(d) Green revolution Indian scientist Indian MS Swaminathan.
18. Biological Oxygen Demand or BOD test measures rate of uptake of O_2 by microorganisms in a sample of water. Greater the BOD of water, more is pollution.
Sample 'C' (500 mg/L) is most polluted because it has highest BOD level among the three samples of water.
19. Biofertilizers are the microorganisms which enrich the nutrient (nitrogen, phosphorus, etc.) quality in the soil. Bacteria, fungi and cyanobacteria are three main sources of biofertilizers. Chemical fertilizers are synthesized in the factories. These are not natural. *Rhizobium* is a symbiotic bacterium that lives in the root nodules of legumes and fixes atmospheric nitrogen into organic compounds utilized by plants.
20. a. — Origin of plumule. It grows into shoot system.
b. —Cotyledons. It stores food for the germinating seed.
c. —Origin of radicle. Radicle grows into root system.
21. (a) FSH and LH. High and progesterone low during 13th and 14th day of menstrual cycle. FSH and LH. Low and progesterone high during 21st to 23rd day of menstrual cycle.
(b) In luteal Phase.
(c) After fertilization, the endometrium of corpus luteum helps in implantation of embryo.
22. (a) Intron
(b) DNA finger printing
(c) Cuts specific nucleotide sequence
(d) Extrachromosomal DNA in bacteria/vector
(e) Modified organisms/organisms with foreign gene
(f) SNP
23. (a) AB, CD
(b) AB
(c) CD
(d) Template strands. Parental DNA strands complementary to which new strands of DNA are synthesized. Okazaki pieces are small pieces of DNA complementary to template
(e) 5' → 3'
24. (a) Allelic frequencies in the gene pool of a population remains unchanged for generations.
(b) It shows Hardy-Weinberg equilibrium.
(c) The factors which can upset the genetic equilibrium are mutation/natural selection : gene flow/genetic drift/migration.
(d) Gene flow when individuals migrate to another place or population, new genes or alleles are added to new population and are lost from old population, in turn changing the frequencies. When gene migration occurs many times it is called gene flow.

OR

- (i) Certain larvae of mosquitoes born with

- (ii) They conferred resistance to DDT.
- (iii) DDT sensitive larvae died.
- (iv) DDT resistant larvae completed life history and became adult mosquitoes.
- (v) Natural selection caused greater reproduction of DDT resistant mosquitoes, which soon replaced DDT sensitive mosquitoes.

25. (a) HIV replication steps in child suffering from thalassemia.



Note Infected cell can survive while viruses are being replicated and released

- (b) The child's immunity deteriorates because the viral DNA attacks helper T-lymphocytes, which are responsible for immunity. The virus replicates and attacks other T-lymphocytes whose number decreases.
 - (c) ELISA—Enzyme Linked Immunosorbent Assay used to diagnose the infective virus.
26. Heterotrophic microbes naturally present in sewage are used for sewage treatments their vigorous growth use up organic matter and reduce BOD of waste effluent and reduce BOD of waste. Some other kinds of bacteria grow in it anaerobically and digest

the bacteria and fungi called flocs (masses of bacteria associated with fungal filaments). As they digest flocs, a mixture of CH_4 , H_2S and CO_2 or biogas are evolved, which can be used as fuel.

27. The technique shown in diagram is genetic engineering/recombinant DNA technology.

- (i) Method is segment of DNA removed from human cell.
- (ii) DNA segment removed is incorporated into bacterial plasmid.
- (iii) Plasmid taken up into bacterial cell which makes protein directed by the human DNA.

28. (a) In curing diabetes mellitus.

- (i) Two DNA sequences which code for two insulin polypeptides A and B have been synthesized.
- (ii) Both of these are introduced into plasmids of *E. coli* to produce insulin chains.
- (iii) A and B chains were produced separately, they were extracted and combined by disulphide bonds to form humulin.

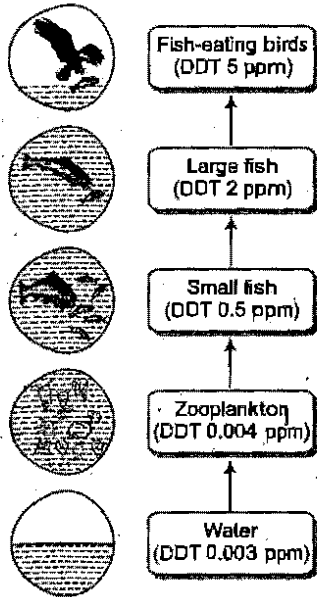
(b) In raising pest resistant plants.

- (i) *Bacillus thuringiensis* (Bt) produces a crystal protein called cry protein which is toxic to certain insect larvae.
- (ii) Cry gene, coding for protein has been isolated and introduced into a number of crop plants like cotton, tomato, corn, rice, potato, etc. All these plants show pest-resistance.

(c) In producing more nutritionally balanced milk.

- (i) Rosie A transgenic cow has been produced which yields human protein-enriched milk.
- (ii) This milk is rich in human alpha-lactalbumin which is nutritionally balanced for human infants.

Some ethical standards should be followed to evaluate the human activities in terms of biotechnological research.



OR

Cloning vectors-

- (i) Plasmids, (ii) Bacteriophages.

Features required to facilitate cloning into a vector are:

- (i) **Origin of replication (*ori*)** The sequence where replication starts and any piece of DNA when linked to this sequence can be made to replicate within host cells is called origin of replication.
- (ii) **Selectable marker** It helps in identifying and eliminating non transformants and selectively permitting the growth of the transformants.
- (iii) **Cloning sites** A few or single recognition sites are preferable.
- (iv) **Vectors for cloning genes required plants and animals** are genetically modified *Agrobacterium tumefaciens* and retroviruses.

29. (i) CO₂
- (ii) Burning of fossil fuels—Petrol/diesel produce carbon dioxide which mix in atmosphere.
- (iii) High levels of carbon dioxide in air causes global warming. CO₂ is a greenhouse gas which absorbs infrared radiations emitted by Earth. When its level rise in air, temperature of Earth increases.

- (iv) Global warming can lead to long summer and meltins of Himalayan caps leading to flood.
- (v) Methods to reduce global warming are :
- Use less fossil fuels.
 - Improve energy efficiency.
 - Plant more trees.
 - Reduce deforestation.

Decline in bird population occurred because excess concentration of DDT occurred in the body of bird. This interferes with calcium metabolism and causes thinning of egg shell. Due to this, egg break prematurely leading to decline in bird population.

30. (a) In mutation (A) both the codons GAA and GAG code for glutamic acid. It means the codon is degenerate.

Since, the amino acid coded did not change, there is no change in the polypeptide. So, the haemoglobin is normal.

In mutation (B), when the codon GAA is changed to GUG, the new codon codes for valine. Thus, the polypeptide is changed leading to haemoglobin change resulting into sickle cell anaemia.

- (b) tRNA has an anticodon loop that has bases complementary to the code.
It also has an amino acid acceptor end via which it binds to amino acids.
- (c) (i) The process is called as charging of rRNA or aminoacylation of tRNA.
(ii) This is to form peptide bond which requires energy.

OR

DNA is packaged in the cell in the following manner.

- (i) In eukaryotes, nucleosomes consist of histone octamer around which the positively charged DNA is wrapped around. A typical nucleosome contains 200bp of DNA helix.
- (ii) Nucleosomes constitute the repeating units of chromatin which are thread-like stained bodies.
- (iii) These nucleosomes can be seen as 'beads-on-string structures, when observed under electron microscope.
- (iv) These 'beads-on-string structures' are packaged to form chromatin fibres that are further coiled and condensed at metaphase stage of cell division to form chromosomes.