Class: XII
SESSION : 2022-2023
SUBJECT: BIOLOGY (044)
SAMPLE QUESTION PAPER - 13
with SOLUTION

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. Advantage of cleistogamy is: **[1]**

a) higher genetic variability
b) Vivipary
c) No dependence on pollinators
d) More vigorous offspring

2. The technology of biogas production from cow dung was developed in India largely due to the efforts of: **[1]**

a) Indian Agricultural Research Institute and Khadi & Village Industries Commission
b) Gas Authority of India
c) Oil and Natural Gas Commission
d) Indian Oil Corporation

3. Which of the following would necessarily decrease the density of a population in a given habitat? **[1]**

a) Natality > mortality
b) Immigration > emigration
c) Natality and immigration
d) Mortality and emigration

4. World wide, at present, the total area of hot spots is **A** and total area of tropical rain forest is B. Identify the A and B respectively. **[1]**

a) More than 2%, less than 6%
b) Less than 2%, less than 6%
c) Less than 2% more than 14%
d) Less than 2%, more than 6%

5. Which group of bacteria found in both the rumen of cattle and sludge of sewage treatment? **[1]**

a) Rhizobium
b) Glomus
c) Methanogens
d) Oscillatoria

6. The inner cell mass which has the potency to give rise all tissue and organs is called: **[1]**

a) Stem cells
b) Germ cells
c) Cleavage cells
d) Embryo cells

7. The daughters born to haemophilic father and normal mother could be **[1]**

a) Carrier
b) All of these
c) Haemophilic
d) Normal

8. A single gene is composed of: [1]

a) Several triple codons
b) One chromosome
c) Part of a strand of DNA double helix
d) One triple codon

9. Function of filiform apparatus is to: [1]

a) Stimulate division of generative cell
b) Produce nectar
c) Guide the entry of pollen tube
d) Recognize the suitable pollen at stigma

10. Transgenic mice are developed use in testing the safety of: [1]

a) Antiseptics
b) Antibiotics
c) Antipyretics
d) Vaccine

11. Rice production is increased by: [1]

a) Sesbania
b) Anabaena
c) Bacillus polyminar
d) Bacillus papipli

12. The total number of essential amino acids in living beings is: [1]

a) Eight
b) Fifteen
c) Twenty two
d) Twenty

13. **Assertion (A):** In human beings, 23 pairs of chromosomes are present in diploid cells. [1]
Reason (R): 22 pairs of chromosomes are equal in male and female but a pair sex chromosome is different in them.

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

14. **Assertion (A):** tRNA acts as an adapter molecule. [1]
Reason (R): tRNA recognizes codon sequence of mRNA during translation.

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

15. **Assertion (A):** Atavism is the reappearance of disappeared ancestral characters. **[1]**
Reason (R): Third molars and hair on body are examples of atavism.

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

16. **Assertion (A):** Tetanus can be diagnosed by Mantoux test. **[1]**
Reason (R): In Mantoux test, the dye gives colour to tetanospasmin.

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

Section B

17. List five growth conditions that a bioreactor provides for obtaining the desired product. **[2]**

18. Define reproductive health. How does this affect society? **[2]**

19. How do the back cross and test cross differ? **[2]**

20. What is the function of Leydig cells? **[2]**

21. How does a population become 'founders' of a new species? **[2]**

OR

How is Cuscuta adapted to be a parasitic plant?

Section C

22. How can sewage be used to generate biogas? Explain. **[3]**

23. Explain the formation and fate of primary germ layers in the human embryo. **[3]**

24. When a cross is made between a tall plant with yellow seeds (Tt Yy) and tall plant with green seed (Tt yy), what proportion of phenotype in the offspring could be expected to be - **[3]**

i. Tall and green

ii. Dwarf and green

25. Pollen banks are playing a very important role in promoting plant breeding programme the world over. How are pollens preserved in the pollen banks? Explain how are such banks benefitting our farmer? Write any two ways. **[3]**

OR

What is entomophyly? Describe the features of entomophilous flowers.

26. Why are **[3]**

(i) alien species invasion and

(ii) loss of habitat and fragmentation considered to be the major cause of loss of biodiversity? Explain with the help of one example each.

27. Describe the advantages for keeping the ecosystem healthy. **[3]**

28. Why medical termination of pregnancy is done? Is MTP legalized in India? **[3]**

Section D

29. **Read the text carefully and answer the questions:** **[4]**

Study the schematic representation of the genes involved in the lac operon given below and answer the questions that follows:

p	i	p	o	z	y	a

(i) Identify and name the regulatory gene in this operon. Explain its role in 'switching off the operon.

(ii) Why is lac operon's regulation referred to as negative regulation?

(iii) Name the inducer molecule and the products of the genes z and y of the operon.

OR

Write the function of these gene products.

30. **Read the text carefully and answer the questions:** **[4]**

Aayush's uncle is very worried as his crop is destroyed by insects. He suggests his uncle use Bt-crops. His uncle is not satisfied with his opinion; he thought that such crops produce toxins which can harm the consumers.

(i) What are Bt-crops?

(ii) Bt cotton is protected by which insects?

(iii) At which pH toxin activated in the gut of insects?

OR

How will activated toxin kill the insects?

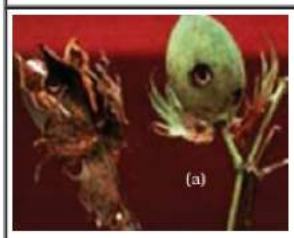
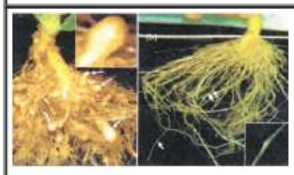
Section E

31. Describe the process of amplification of the gene of interest using PCR technique. **[5]**

OR

GM is a technology that involves inserting DNA into the genome of an organism. To produce a GM plant, new DNA is transferred into plant cells. Usually, the cells are then grown in tissue culture where they develop into plants. The seeds produced by these plants will inherit the new DNA.

Given below is a table depicting the different genetically engineered plants and the organism used.

Genetically engineered plants	Organism used
	(a) _____
	(b) _____

i. Name the organisms used in (a) and (b).

ii. Write the name of plants (a) and (b).

iii. Which organisms infect the plants? **OR**

iv. How do these plants are genetically engineered?

32. An active member of an awareness group conducts regular programmes to sensitise public against alcoholism youth-a serious health hazard in his locality. Identify the values this member of the group is trying to propagate amongst the people in his locality. **[5]**

OR

A person in your colony has recently been diagnosed with AIDS. People/residents in the colony want him to leave the colony for the fear of spread of AIDS.

i. Write your views on the situation, giving reasons.

ii. List the possible preventive measures that you would suggest to the residents of your locality in a meeting organised by you so that they understand the situation.

iii. Write the symptoms and the causative agent of AIDS.

33. i. How did Hardy-Weinberg explain that allelic frequencies in a population are stable and are constant from generation to generation? **[5]**

ii. Why does genetic equilibrium gets disturbed in a population? Give reason.

OR

Describe the various evidences from palaeontology which support organic evolution.

SOLUTION

Section A

1. **(c)** No dependence on pollinators
   Explanation: No dependence on pollinators

2. **(a)** Indian Agricultural Research Institute and Khadi & Village Industries Commission
   Explanation: The technology of biogas production was developed in India mainly due to the efforts of the Indian Agricultural Research Institute (IARI) and Khadi and Village Industries Commission (KVIC).

3. **(d)** Mortality and emigration
   Explanation: Mortality and emigration add individuals to initial density hence increases the population density.
4. **(b)** Less than 2%, less than 6%
   Explanation: Less than 2%, less than 6%
5. **(c)** Methanogens
   Explanation: Methanogens
6. **(a)** Stem cells
   Explanation: The inner cell mass (embryo) contains certain cells called stem cells that have the capability to give rise to all tissues or organs in adults.
7. **(a)** Carrier
   Explanation: The possibility of a female becoming haemophilic is extremely rare because the mother of such a female has to be at least carrier and the father should be haemophilic. If a female has a haemophilic gene on one of either X chromosome then she will be a carrier of the disease.
8. **(c)** Part of a strand of DNA double helix
   Explanation: Part of a strand of DNA double helix
9. **(c)** Guide the entry of pollen tube
   Explanation: Guide the entry of pollen tube
10. **(d)** Vaccine
    Explanation: Transgenic mice are developed for use in testing the safety of vaccine before use on human beings. Polio vaccine was first tested on mice for its safety before use on humans.
11. **(b)** Anabaena
    Explanation: Anabaena
12. **(d)** Twenty
    Explanation: Twenty
13. **(a)** Both A and R are true and R is the correct explanation of A.
    Explanation:
    - In human beings, 23 pairs of chromosomes are present in diploid cells.
    - Twenty-two pairs of chromosomes are equal in male and female but a pair sex chromosome is different in them. Male contains XY and females contain XX sex chromosomes.

14. **(b)** Both A and R are true but R is not the correct explanation of A.
Explanation: t-RNA is an adaptor molecule because it adapts amino acid to bring it to protein synthesis site in activated form and not because it recognises the codon on mRNA.
15. **(c)** A is true but R is false.
Explanation: Atavism is the appearance of certain ancestral characters which had either disappeared or were reduced. There are present some examples of atavism in human being, viz., the power of moving pinna in some persons, greatly developed canine teeth, exceptionally long dense hairs, short tail in some babies and presence of additional mammae in some individuals. Third molars and hair on the body are examples of vestigial organs.
16. **(d)** A is false but R is true
Explanation: Tetanus caused by the bacillus Clostridium tetani. Montex test is performed to determine susceptibility of tuberculosis.

Section B

17. A bioreactor provides five growth conditions for obtaining the desired products are:
    i. facilitate the mixing of reactor contents
    ii. oxygen availability through oxygen delivery system
    iii. foam control system
    iv. temperature control system
    v. pH control system and sampling parts for examining small volume of cultures periodically.

18. Reproductive health: It means total well-being in all aspects of reproduction i.e., physical, emotional, behavioural and social.
A society with the people having physically and functionally normal reproductive organs and normal emotional and behavioural interaction among them in all sex-related aspects is called reproductively healthy society.
19. i. A back cross is between a hybrid organism and any one of the parents while a test cross is between a hybrid organism and a recessive parent,
    ii. Back cross is performed a few times in order to increase the traits of that parent whereas a test cross is performed to know whether an individual is homozygous or heterozygous for that character.
20. Leydig cells are interstitial cells located adjacent to the seminiferous tubules in the testes. The best-established function of Leydig cells is to produce the androgen, testosterone, under the pulsatile control of pituitary luteinizing hormone (LH).
21. In genetic drift, when in a section of the migrated population the change in allele frequency is so different that they become a new species, the original drifted population becomes founders and the effect is called founder's effect.

OR

Cuscuta produces haustoria to derive nutrition from the host plant. Cuscuta has haustorial or sucking roots which penetrate into the xylem and phloem vessels of the host plant and thus it can derive it's nutrition.

Section C

22. i. When BOD of sewage gets reduced, it is passed into a settling tank. The bacterial flocs settle in the tank and the sediment is called activated sludge. A small amount of activated sludge is pumped back into the aeration tank to serve as inoculum.
    ii. The remaining major part of the sludge is pumped into large tanks called anaerobic sludge digesters, where other kinds of bacteria, which grow anaerobically, digest the bacteria and the fungi in the sludge.
    During this process, bacteria produce a mixture of gases, such as methane, hydrogen sulphide and carbon dioxide, which form biogas.
    The effluent from secondary treatment is generally released into natural water bodies. It helps to reduce water pollution and water-borne diseases.

23. The blastocyst consists of inner cell mass (ICM) and trophoblast. The cells of ICM move that help to attain new shape and morphology of the embryo. These cell movements are called morphogenetic movements. The ICM differentiates into outer ectoderm and an inner layer called endoderm. A mesoderm soon appears between the ectoderm and endoderm. The morphogenetic movements transforms the blastocyst into a three layered structure called gastrula.
    Fate of ectoderm. It gives rise to epidermis of skin, entire nervous system, enamel of teeth and some of the endocrine glands.
    Fate of Endoderm. It gives rise to digestive and respiratory system, urinary bladder, thyroid, parathyroid and thymus glands.
    Fate of Mesoderm. It gives rise to the skeletal, circulatory systems, kidneys, gonads, muscles and reproductive system.

24. Parents: Tall Yellow Tt Yy × Tall Green Tt yy

Gametes: (TY) (Ty) (tY) (ty) × (Ty) (ty)

	TY	Ty	tY	ty
Ty	TT Yy	TT yy	Tt Yy	Tt yy
ty	Tt Yy	Tt yy	tt Yy	tt yy

Phenotypic ratio:
Tall yellow : tall green : Dwarf yellow : dwarf green
3 : 3 : 1 : 1
Tall and green = 3
Dwarf and green = 1.

25. Pollen banks are used to store pollens for a very long period of time in viable conditions. Pollens are preserved in a bank using cryopreservation i.e., they are stored in a viable condition in low-temperature conditions(-196 degree Celsius) using liquid nitrogen.
The important applications of pollen banks for our farmers are the following :
i. To preserve the agricultural biodiversity in the form of preservation of valuable genetic resources.
ii. These pollens can be used in various crop hybridization breeding programmes, biochemical and physiochemical studies such as the study of allergens etc.

OR

It is a mode of cross pollination in which the pollen grains are transferred to the stigma through the insects like bees, butterflies etc.
Features of Entomophilous flowers : The flowers are generally large, colourful, fragrant and rich in nectar. Pollen grains are often surrounded by a sticky substance, pollenkit.
spec es.

26. (i) The alien species become invasive and cause a decline or extinction of indigenous
i

e.g. the Nile Perch introduced into Lake Victoria in east Africa led to the extinction of more than 200 species of Cichild fish in the lake.

(ii) Habitat loss and fragmentation deprive the organisms of their natural home and hence leads to their extinction.

When large habitats are broken up into small fragments, mammals and birds which require large territories and certain animals with migratory habits are seriously affected. This leads to decline in their population.

e.g. When the Amazon forest is cut and cleared for conversion into grasslands, many species are affected due to destruction of their habitat.

27. The various benefits that humans obtain from the ecosystem are collectively called ecosystem services.

The advantages of keeping an ecosystem healthy can be grouped into the following types:

i. **Provisioning services:** Fruits, vegetables, trees, fishes and livestock are directly available to us by ecosystem The other benefits in this category are timber, oils, medicines.etc.

ii. **Regulating services:** These are benefits that moderate natural phenomena. These include pollination, decomposition, flood control, etc.

iii. **Cultural services:** It contributes towards the development and advancement of people, e.g. recreation facilities, etc, spiritual healing

iv. Supporting services allow the earth to sustain basic life forms, e.g., photosynthesis, water cycle, etc.

28. MTP is done to get rid of unwanted pregnancies either due to unprotected intercourse or failure of the contraceptives used during coitus or rapes. It is also essential in certain cases where continuation of the pregnancy could be harmful or fatal either to the foetus or mother.

Yes, Government of India legalized MTP in 1971 with some conditions to avoid its misuse.

Section D

29. **Read the text carefully and answer the questions:**

Study the schematic representation of the genes involved in the lac operon given below and answer the questions that follows:

p	i	p	o	z	y	a

(i) i gene-regulatory gene.

It codes for the repressor protein of the operon, which is synthesised constitutively. The repressor has the affinity for the operator gene. It binds to the operator and prevents the RNA polymerase from transcribing the structural genes.

(ii) When repressor binds to the operator, the operon is switched off and transcription is stopped. So, it is called negative regulation.

(iii)Lactose is an inducer molecule.

Gene 'z' codes for β-galactosidase, which is responsible for the hydrolysis of lactose into galactose and glucose.

'y' gene codes for permease. It increases the permeability of the cell to lactose.

OR

'y' gene codes for permease. It increases the permeability of the cell to lactose.

30. **Read the text carefully and answer the questions:**

Aayush's uncle is very worried as his crop is destroyed by insects. He suggests his uncle use Bt-crops. His uncle is not satisfied with his opinion; he thought that such crops produce toxins which can harm the consumers.

(i) Bt crops are genetically modified plants containing the endoscope toxins of the bacterium bacillus thuringiensis.

(ii) Bt cotton is protected by certain insects such as lepidopteran (tobacco budworm) beetles and flies.

(iii)Bt toxin is activated in the gut of the insect due to the alkaline pH.

OR

The activated toxin binds to the surface of the midgut epithelial cell and creates pores that cause cell swelling and lysis leading to the death of an insect.

Section E

31. Amplification of a gene segment of the interest needs two sets of primers (small chemically synthesized oligonucleotide) that are complementary to the gene of interest, DNA polymerase enzyme, and deoxynucleotides with different conditions of incubation.

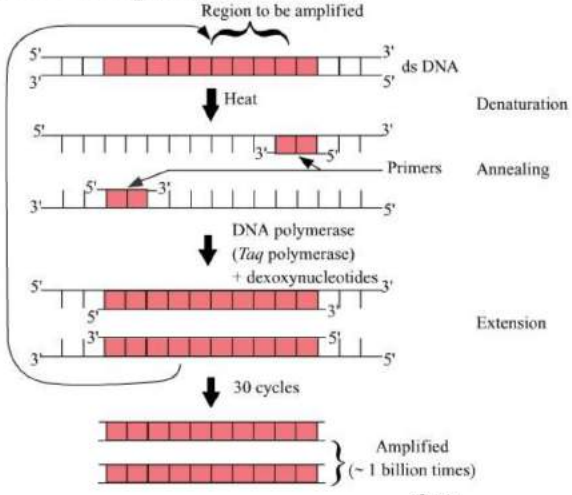
The process of PCR consists of 3 steps:

i. **Denaturation** − The double-helical DNA is denatured by incubating the gene of interest at high temperature (around 95^{O}C) in PCR cycler. Since the DNA polymerase used is isolated from thermophilic bacteria *Thermus aquaticus* (*Taq* polymerase), it does not get degraded at such high temperature.

ii. **Annealing-** In this step, the temperature is lowered to around 55^{O}C to allow the primers to get annealed to the single-stranded DNA templates. The DNA polymerase enzyme extends the primer in 5' to 3' direction thus starting the amplification of DNA.

iii. **Extension** − The temperature for this step is increased to around 72^{O}C. Thus the extension of the DNA takes place here *in vitro*.

These steps are run for around 30 cycles or as per the need to get the amplified product (~1 billion copies).



OR

i. The organism used to develop (a) is *Bacillus thuringiensis* and (b) is Agrobacterium.

ii. The name of the plant which is genetically engineered by (a) is Cotton and (b) is Tobacco.

To developed the resistant variety of Cotton plant against the infection of Bollworm, Bt-toxin gene has been cloned from the bacteria and been expressed in plants without the need for insecticides.

In the case of Tobacco plant, a nematode *Meloidogyne incognitia* infects its roots which results in the reduction of yield. To develop a resistant variety, RNA interference (RNAi) technology is used. Using Agrobacterium vectors, nematode-specific genes were introduced into the host plant. The introduction of DNA was such that it produced both sense and anti-sense RNA in the host cells. These two RNA's being complementary to each other formed a double-stranded (dsRNA) that initiated RNAi and thus, silenced the specific mRNA of the nematode.

32. The dependence or addiction of alcohol is called alcoholism and the addict to alcohol is termed alcoholic. The word alcohol refers to ethyl alcohol or ethanol (C_2H_5OH). It is manufactured by fermentation of sugars.

An active member sensitises the public by making them aware of the problems caused by alcohol amongst youths.

These problems are:

i. **Social problems-** Unemployment, child abuse, marital tension, financial difficulties and a problem with the law such as violence, traffic offences.

ii. **Psychological problems-** Depression, deterioration of the sexual relationship, anger and rude, hangover problem in the morning.

iii. **Physical problems-** Variable and can affect virtually any organ in the body such as cardiovascular, gastrointestinal, CNS, liver and reproductive system.

The member of the awareness group is trying to aware the people that alcoholism is a curse in the people. Many adolescents get affected physically and mentally. He is propagating values: observation, service to society, empathy, problem-solving and sense of responsibility.

OR

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.

33. i. Hardy-Weinberg proposed the genetic equilibrium principle. It says that the allele frequencies in a population are stable and constant from generation to generation. The gene pool remains constant. Sum total of all the allelic frequencies is 1. The Hardy-Weinberg principle is applicable only under the following conditions:
    a. **No Mutation:** There should not be either gene or chromosomal mutation.
    b. **No Gene Migration:** There must be no exchange of genes (gene flow) between the populations. All genes must have an equal chance of being passed to the next generation.
    c. **No Genetic Drift:** Genetic drift refers to a change in the population of alleles in the gene pool by chance. The population must be very large and no genetic drift should occur.
    d. **Random Mating**: The population must reproduce sexually and mating must be random.
    e. **No Natural Selection Pressure:** There must be no natural selection pressure with respect to the alleles under study.

    According to the Hardy-Weinberg equilibrium Principle, gene frequencies will remain constant if all the above five conditions are met. Constant gene frequencies over several generations indicate that evolution is not taking place. Changing gene frequencies would indicate that evolution is in progress. In other words, evolution occurs when the genetic equilibrium is not constant.

    ii. Genetic equilibrium gets disturbed in a population because of five factors including gene migration or gene flow, genetic drift, mutation, genetic recombination and natural selection.

OR

The evidence for organic evolution are as follow:

i. **Fossils/ Paleontology evidence:** Fossils of earliest life are scanty and only of prokaryotes mostly. Eukaryotes developed later on.

ii. **Disparity between fossils:** Present-day organisms seem to be related to the fossils of the quaternary period but differ from those of the tertiary period. Fossils of the quaternary period are similarly related to the tertiary period but differ from the ones of the Cretaceous period. These differences are due to changes in the form, structure, and habits of organisms due to evolution.

iii. **Extinct organisms:** Lots of organisms existed on earth for some time and then got extinct like dinosaurs, toothed birds, pteridosperms, giant horsetails, ancestors of man, etc. Extinction happened due to many factors. Some of the extinct forms have left their modified descendants (Man, modern-day Horse) while others have perished without leaving any descendants (Pteridosperm, Dinosaurs).

iv. **Missing Links:** These are transitional or intermediate forms between two groups of organisms which occur only in the fossil state. E.g., *Seymouria,* a missing link between amphibia and reptilia.

v. **Plant vs Animal Fossils:** Ancestral animals have left more fossils as compared to plants evidently due to the presence of slow decaying harder structures in their exoskeleton and endoskeleton.