

**Bangalore Sahodaya Schools Complex Association Pre-Board
Examination I (2024-2025)**

Class: XII Biology (Code - 044) – Set - 1

**Duration: 3 Hours
Maximum Marks: 70**

Section - A

1. Identify the correct statements regarding the structure of an angiospermic microsporangium and select the correct option.

- i. In a transverse section, a typical microsporangium appears nearly circular in outline**
- ii. Each microsporangium is surrounded by four wall layers-epidermis, endothecium, middle layers, and tapetum**
- iii. The outer three layers, epidermis, endothecium, and middle layers, are protective and also help in the dehiscence of anthers.**
- iv. In a young anther, the centre of the microsporangium is occupied by a group of compactly arranged homogenous cells, which form microspores by mitosis.**
- v. The cells of tapetum undergo meiosis.**

- a) i,ii & iii
- b) i, iii & v
- c) ii, iii & iv
- d) ii, iii & v

Ans: a) i,ii & iii

2. Which of the following is prepared by acetylation of morphine?

- a) Cocaine
- b) Heroin
- c) Hashish
- d) Marijuana

Ans: b) Heroin

3. Other than exactly counting the organisms, population density can be estimated in terms of

- a) percent cover in large trees with an expanded canopy
- b) biomass, in large plants
- c) number caught per trap for fishes
- d) all of these

Ans: d) all of these

4. In a snapdragon, a cross between a red-flowered (RR) plant and a white flowered (rr) plant resulted in a pink-flowered progeny. If a cross is made between a pink-flowered plant and a white flowered plant, the expected phenotypic ratio in the progeny will be

- a) 1 pink flowered: 1 white flowered
- b) 1 red flowered: 1 white flowered
- c) 3 pink flowered: 1 white flowered
- d) 1 red flowered: 2 pink flowered: 1 white flowered

Ans: a) 1 pink flowered: 1 white flowered

5. Match the organisms with their use in biotechnology.

Column I	Column II
A. <i>Bacillus thuringiensis</i>	1. Cloning vector
B. <i>Thermus aquaticus</i>	2. Construction of first rDNA
C. <i>Agrobacterium tumefaciens</i>	3. Cry proteins
D. <i>Salmonella typhimurium</i>	4. DNA polymerase

- a) A-4, B-3, C-1, D-2
- b) A-3, B-2, C-4, D-1
- c) A-3, B-4, C-1, D-2
- d) A-4, B-1, C-2, D-3

Ans: c) A-3, B-4, C-1, D-2

Column I	Column II
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6. Which of the following is not a function of placenta in a pregnant woman

- a) facilitate the supply of oxygen nutrients to embryo
- b) facilitate the removal of carbon dioxide and other metabolic waste from the embryo
- c) secretion of hormones like HCG and progesterone that are needed for maintaining pregnancy

d) secretion of oxytocin for parturition

Ans: d) secretion of oxytocin for parturition

7. The microbes that can be cultured in the labs are

a) viruses and fungi

b) protozoans and viruses

c) bacteria and fungi

d) prions and bacteria

Ans: c) bacteria and fungi

8. Which of the following statements is not true for the double helical structure of DNA proposed by Watson and Crick

a) The two strands of DNA are complementary to each other under antiparallel.

b) The backbone of the molecule is constituted by nitrogen bases, which project outwards

c) Nitrogen bases in the two strands are paired through hydrogen bonds forming base pairs (bps).

d) The two strands are called in a right-handed fashion, with the pitch of the helix being 3.4nm

Ans: b) the backbone of the molecule is constituted by nitrogen bases which project outwards

9. In a grassland ecosystem if the number of primary producers grasses is approximately 6 millions the number of tertiary consumers that can be supported will be

a) 3

b) 6

c) 30

d) 60

Ans: a) 3

10. The microbial biocontrol agent a bacterium whose dried spores are used to kill the insect larvae eating brassicas, is

a) *Agrobacterium tumefaciens*

b) *Bacillus thuringiensis*

c) *Salmonella typhimurium*

d) *Methanobacterium* sp.

Ans: b) *Bacillus thuringiensis*

11. It is observed that the species diversity decreases as we move

a) away from the equator to poles

b) towards equator from poles

c) along the equator

d) from deserts to rainforests

Ans: a) away from the equator to poles

12. The most important cause of extinction of animals and plants especially in tropical rain forests is

- a) habitat loss
- b) afforestation
- c) pollution
- d) soil erosion

Ans: a) habitat loss

Question No. 13 to 16 consist of two statements – Assertion (A) and Reason (R).

Answer these questions selecting the appropriate option given below:

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

13. Assertion: Cleistogamous flowers do not require any pollinating agent, yet they have assured seed set.

Reason: Cleistogamous flowers are bisexual flowers which stamen and pistil placed closer to each other.

Ans: a) Both A and R are true, and R is the correct explanation of A.

14. Assertion: Divergent evolution leads to the development of homologous organs that are similar in function.

Reason: Homologous organs are different in their anatomy and origin but are similar in function.

Ans: a) Both A and R are true, and R is the correct explanation of A.

15. Assertion: A probe having radioactive isotope is helpful in detecting specific DNA sequences

Reason: The probe is often a single-stranded DNA with base sequences complementary to the DNA sequence to be detected.

Ans: a) Both A and R are true, and R is the correct explanation of A.

16. Assertion: The recent studies show that Gause's competitive exclusion principle cannot hold good always.

Reason: The different species living in a habitat may show resource partitioning.

Ans:

- c) A is true, but R is false.

Section - B

17. Why is aerobic degradation more important than anaerobic degradation for the treatment of large volumes of wastewater rich in organic matter. Discuss.

Ans: The aerobic degradation of sewage is carried out by the aerobic heterotrophic microbes, i.e. certain bacteria and fungi, present in the sewage.

During their vigorous growth, the aerobic microbes consume a major part of the organic matter and reduce the BOD significantly; hence, this aerobic degradation is more important.

In anaerobic degradation, only the bacteria and fungi (i.e. the flocs) in the activated sludge are digested, and no action occurs in the supernatant/water; hence, it is less important than aerobic degradation.

OR

What is withdrawal syndrome?

List any two symptoms it is characterised by.

Ans: Withdrawal syndrome refers to the characteristic and unpleasant manifestations of the body of an addict, when a regular dose of drugs/alcohol is abruptly discontinued.

Characteristics:

- (i) Anxiety
- (ii) Excess sweating
- (iii) Shakiness
- (iv) Nausea
- (v) In some cases, withdrawal symptoms can be severe and even life-threatening.

18. With the decline in the population of fig species it was noticed that population of wasp species also started to decline. What is the relation between the two, and what could be the possible reason for decline of wasps?

Ans: The relationship between the fig species and the wasp species is mutualism, i.e., both are benefited.

The wasp species uses the ovary of the fig flowers as the site for oviposition, and the emerging larvae feed on the developing seeds.

In the absence of fig species, the wasp species loses the place for oviposition and the food for the larvae; hence, their number decreases.

19. Write any two ways, by which apomictic seeds may be developed in angiosperms.

Ans:

- (i) Certain nucellar cells around the embryo sac divide, protrude into the embryo sac, and develop into embryos, e.g., Citrus, mango, etc.
- (ii) The diploid egg cell of the embryo sac, formed without meiosis in the megaspore mother cell, develops into an embryo without fertilisation.

20. Insulin synthesized in the human body needs to be processed before it could function; but the insulin synthesised by Eli Lilly company does not need to be processed. They used recombinant DNA technology to produce insulin.

- a) **Why must the insulin synthesised in the human body undergo processing? Mention the changes it undergoes.**
- b) **What is the major challenge faced by Eli Lilly company in the production of Insulin?**

Ans:

- (a) Insulin is synthesised as a prohormone (proinsulin) with three peptides, A, B, and C. It undergoes maturation when C-peptide is removed and peptides A and B are joined by disulfide bridges.
- (b) The major challenge was assembling the two peptides A and B into the mature form.

21. How is Down syndrome different from Klinefelter's syndrome?

Ans:

Down's syndrome	Klinefelter's syndrome
It is due to trisomy of the 21st chromosome.	It is due to an extra X chromosome in a male.
It is an autosomal disorder.	It is a sex-chromosomal disorder.
The affected individual can be a male or a female	The affected individual is a male, with more feminine characteristics.

Section - C

22. Mention the role of gonadotropins in the menstrual cycle. During what phase of the menstrual cycle do the gonadotropins reach peak levels?

Ans:

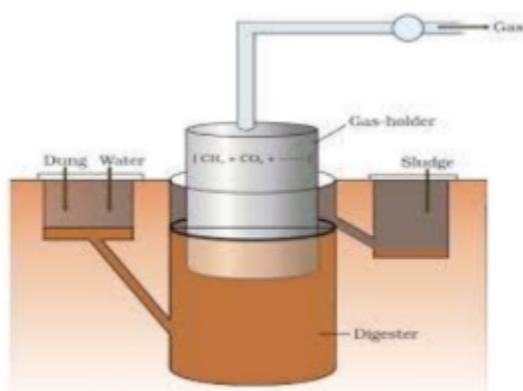
The follicle-stimulating hormone (FSH) stimulates the growth of the primary follicle in the ovary into a mature Graafian follicle.

- It also stimulates the secretion of estrogens by the developing follicle cells.
- Rapid secretion of luteinizing hormone (LH) during the middle of the menstrual cycle, also called the LH surge, causes the rupture of the Graafian follicle and the release of the ovum (secondary oocyte) in the process, called ovulation.
- It also stimulates the formation of the corpus luteum from the ruptured Graafian follicle and the secretion of progesterone from it.

The gonadotropins reach their peak levels in the middle of the menstrual cycle, i.e., about the 14th day of the cycle.

23. Draw a labelled diagram of a typical biogas plant.

Ans:



A Typical Biogas Plant

24. WHO has started a number of programmes to prevent the spreading of AIDS. Mention six such programmes.

Ans: The programmes of WHO include:

- (i) making blood safe from HIV
- (ii) ensuring the use of disposable needles and syringes only in all hospitals
- (iii) free distribution of condoms
- (iv) controlling drug abuse
- (v) advocating safe sex
- (vi) promoting regular check-ups for HIV in susceptible populations

25. a) List any four characteristics of an ideal contraceptive.

b) Name two intrauterine contraceptive devices that affect the motility of sperms.

Ans: (a) An ideal contraceptive should

- (i) be user-friendly.
- (ii) not interfere with the sexual drive, desire, and/or the sexual act.
- (iii) be easily available.
- (iv) be effective and reversible with no or minimal side effects.

(b) Copper ions-releasing IUDs like Cu7, Multiload 375, CuT suppress sperm motility (any two)

26. Given below are the sequences of nucleotides in a particular mRNA and amino acids coded by it.

UUU AUG UUC GAG UUA GUG UAA

Phe - Met - Phe - Glu - Leu - Val

Write the properties of genetic code that can be and that cannot be correlated from the above given data.

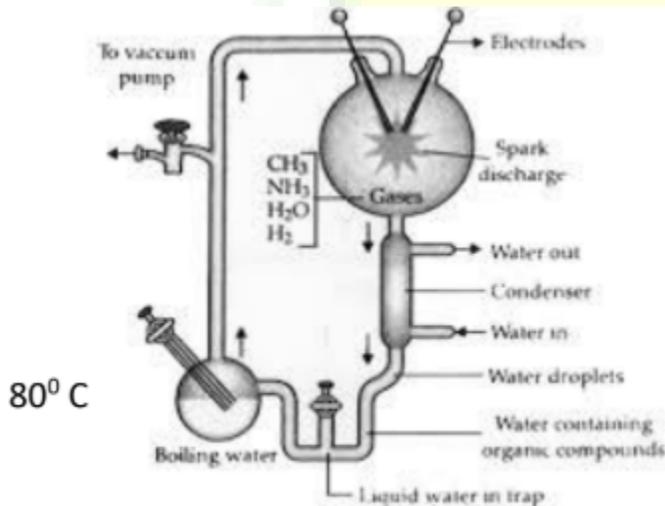
Ans: The properties that can be correlated:

- (i) UAA does not code for any amino acid; it is a termination codon.
- (ii) Genetic code is specific and unambiguous, i.e., one codon codes for a particular amino acid.
- (iii) Each codon is a triplet.
- (iv) Genetic code is degenerate, as one amino acid is coded by more than one codon, e.g., UUU and the UUC code for phenylalanine.
- (v) Genetic code is read in a contiguous manner without any punctuation.

The property that cannot be correlated:

AUG has dual functions; it is an initiation codon as well as codes for methionine.

27. A student was simulating Urey and Miller's experiment to prove the origin of life. The setup used by the student is given below



a) Find out the reasons why you could not get desired results.

b) What conclusion was drawn by Urey and Miller through this experiment.

c) Compare the conclusion reached with the theory of spontaneous generation.

Ans:

(a) He could not get the desired results because:

- (i) Temperature is kept at 80 °C instead of 800 °C
- (ii) Oxygen is used in place of H₂.

(b) Urey and Miller observed the formation of amino acids. They concluded that life originated abiogenetically from pre-existing organic molecules and their formation must have been preceded by chemical evolution.

(c)

- (i) Abiogenesis theory: Life could have come from pre-existing non-living organic molecules, and the formation of life was preceded by chemical evolution. Experimentally proved and accepted.
- (ii) Spontaneous generation theory: Life must have come from decaying and rotting matter, like straw, mud, etc., spontaneously. Experimentally disproved.

28. Write by taking a suitable example the convention followed for naming the restriction enzymes.

Ans: Naming of restriction enzymes

- The first letter of the name comes from the genus of the bacterium.
- The second and third letters come from the name of the species of the prokaryotic cell from which it is isolated.
- The next letter comes from the strain of the prokaryote.
- The Roman Numbers following these four letters indicate the order in which the enzymes were isolated from that strain of the bacterium, e.g., EcoRI is isolated from *Escherichia coli*, RY 13.

OR

DNA, being hydrophilic, cannot pass through the cell membrane of a host cell. Explain how the Recombinant DNA gets introduced into the host cell to transform the latter.

Ans: Introduction of rDNA into a host cell

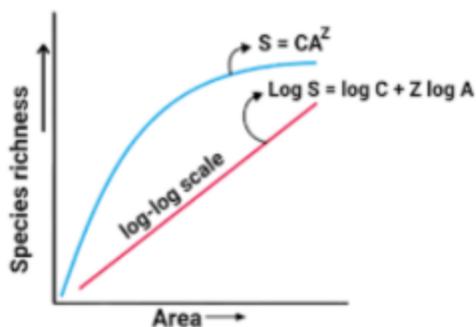
- (i) Microinjection: In this method, the recombinant DNA is directly injected into the nucleus of an animal cell.
- (ii) Gene gun/Biolistics: In this method, used for plant cells, the cells are bombarded with high velocity microparticles of gold or tungsten coated with DNA.
- (iii) Heat shock method: In this method, the rDNA is forced into the competent cell by incubating the cell with rDNA on ice, followed by placing them briefly at 42 °C (heat shock) and then putting them back on ice.

By disarmed pathogen vectors: Disarmed retroviruses are used to introduce rDNA into animal cells, and the Ti plasmid of *Agrobacterium* is used to introduce rDNA into plant cells.

Section - D

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

29. Study the graphical representation of the species-area relationship given below and answer the questions that follow.



- Name the naturalist who studied the kind of relationship shown in the graph and the area he explored.
- Write down the observations made by him.
- What do 'S', 'C', 'Z', and 'A' represent in the given graph?

Ans:

- Alexander von Humboldt. South American jungle.
- Alexander Von Humboldt observed that within a region, species richness increased with increasing explored area, but only up to a limit.
- S — Species richness
 - C — Y-intercept
 - Z — Slope of the line or Regression coefficient
 - A — Area (explored)

OR

When will the 'Z' line become steeper? What will be the range of Z values in that case? Give an example.

Ans: The slope of the line will be steeper when the species-area relationship is analysed for very large areas like the entire continents; steeper slopes indicate high levels of species richness. The range of Z values will be in the range of 0.6-1.2. For frugivorous birds and mammals in the tropical forest of different continents, it is 1.15.

30. A short stretch of DNA that codes for a polypeptide is given below:

3' -CATCATAGATGAAAC- 5'

In the different cells of an organism, two different types of errors have occurred during replication of DNA, and the sequences of bases in the DNA in the two cells are given below:

Cell 1: 3' -CATCATAGATGAATC- 5'

Cell 2: 3' -CATATAGATGAAAC- 5'

- What term is given to the stretch of DNA that codes for a polypeptide?
- Write the type of mutation in
 - cell 1

- ii) cell 2, respectively.
- c)
- i) Write the messenger RNA transcribed by the mutated DNA in cell 1.
- ii) How many amino acids are coded by this messenger RNA? Justify your answer.

Ans:

- (a) It is called a cistron.
- (b) P
- (i) Point (single base substitution) mutation.
- (ii) Frameshift - deletion mutation
- (c)
- (i) 5' GUAGUAUCCACUUAG 3'
- (ii) It will code for four amino acids. The last codon (UAG) is a termination codon that does not code for any amino acid.

OR

Write the messenger RNA transcribed by the mutated DNA in the cell.

How many amino acids will this messenger RNA code for? Justify your answer.

Ans: (c) 5' GUAUAUCUACUUUG 3'.

It will code for four amino acids

Section - E

31. a) Explain the events that occur during pollen-pistil interaction.

b) Explain the following reasons.

i) Pollen grains are well preserved as fossils.

ii) Pollen tablets are in use by people these days.

Ans:

a) Pollen-Pistil Interaction.

- It is a dynamic process involving recognition of the right type (compatible) of pollen and rejection of the wrong type (incompatible) of pollen by the stigma.
- It is mediated by the interaction between the chemical components of the pollen and those of the stigma.
- A compatible pollen grain starts its germination on the stigma.
- The intine grows out through one of the germ pores as a pollen tube.
- The contents of the pollen move into this tube, i.e., the tube nucleus and the generative cell, where pollen is liberated in the two-celled stage or the tube nucleus and the two male gametes in those species where pollen is liberated in the three-celled stage.
- The generative cell divides into two male gametes.

- The pollen tube grows through the tissues of the stigma and style and enters the ovule through the micropyle.
- It enters the embryo sac through the filiform apparatus of one of the synergids to liberate the two male gametes.
- The events from the deposition of pollen on the stigma till the pollen tube enters the ovule are collectively referred to as pollen-pistil interaction.

(b)

- (i) The exine of pollen grains is made of sporopollenin, which can withstand high temperature and action of strong acids or alkalies; no enzyme can degrade sporopollenin and hence, pollen grains are well-preserved as fossils.
- (ii) Pollen grains are rich in nutrients and hence are used in the form of tablets as food supplements.

OR

Explain the process of development of a mature human female gamete from the time it is initiated till the formation of an oocyte.

Ans:

- Oogenesis is the process of the formation of mature female gametes or ova.
- Oogenesis is initiated during the embryonic developmental stage of a female foetus.
- Oogonia formed in the ovary of the fetus start division and enter prophase I of meiosis and remain suspended at that stage; these are called primary oocytes.
- Each primary oocyte is surrounded by a layer of granulosa cells and becomes the primary follicle.
- When a primary follicle becomes surrounded by more layers of granulosa cells and a theca, it is called a secondary follicle.
- The secondary follicle transforms into a tertiary follicle, with the development of a fluid-filled cavity (antrum) around the primary oocyte.
- The theca becomes organised into an outer layer, called theca externa, and an inner layer, called theca interna.
- At this stage, the primary oocyte grows in size and completes meiosis I and forms a larger haploid secondary oocyte and a tiny first polar body.
- The tertiary follicle grows further and changes into the mature follicle or Graafian follicle; the secondary oocyte secretes a new membrane, called the zona pellucida, around it.
- At this stage, the follicle ruptures to release the secondary oocyte (i.e., ovulation), which moves into the fallopian tube.
- When a sperm enters the cytoplasm of the secondary oocyte, it completes meiosis II, resulting in an ootid (ovum), and a second polar body.

32. A cross was carried out between a pea plant, heterozygous for round and yellow seeds, with a pea plant having wrinkled and green seeds.

a) Show the cross in a Punnett square.

b) Write the phenotypes of the progeny of the cross.

c) What is this cross known as? State the purpose of conducting such a cross.

Ans:

a) Parents:

Round, yellow (RrYy) X Wrinkled, green (rryy)

Gametes of RrYy- RY, Ry, rY, ry

Gametes of rryy- ry

Gametes	RY	Ry	rY	ry
ry	RrYy	Rryy	rrYy	rryy
Phenotype	Round yellow	Round green	Wrinkled yellow	Wrinkled green

(b) The phenotypic ratio of the progeny is as follows :

1 Round yellow: 1 Round green: 1 Wrinkled yellow: 1 Wrinkled green

(c) This is a test cross

It is used to determine the genotype of an individual with a dominant phenotype.

OR

a) How did Darwin explain adaptive radiation? Give another example exhibiting adaptive radiation.

b) Name the scientist who influenced Darwin and how?

Ans:

(a) Adaptive radiation is the process of evolution of different species in a given geographical area, starting from a point and literally radiating to other geographical areas or habitats.

- Darwin's finches are an example of adaptive radiation.
- There were many varieties of small black birds in the Galapagos Islands, which are known as Darwin's finches.
- Darwin reasoned that after originating from a common seed-eating stock, the finches must have radiated to different geographical locations on the same island and undergone adaptive changes, especially in the type of beak, enabling them to be insectivorous or vegetarian finches.
- Living in isolation for a long time, new kinds of finches emerged that could survive and function in the new habitats.
- Australian marsupials also show adaptive radiation.

(b) Thomas Malthus influenced Darwin.

Malthus, in his Essay on Population, mentioned that population size grows exponentially, while factors of sustenance grow arithmetically. So, the population size in reality is limited, i.e., there is competition for resources, in which only some survive and grow at the cost of the others, who cannot flourish (survival of the fittest).

33. Unless the vector and source DNAs are cut, fragments separated, and joined, the desired

recombinant vector molecules cannot be created.

a) How are the desired DNA sequences cut?

b) Explain the technique used to separate the cut fragments.

c) How are the resultant fragments joined to the vector molecule?

Ans:

- (a) The purified DNA molecule containing the desired gene is incubated with the specific restriction endonuclease at optimal conditions of pH, temperature, etc. of that enzyme. Similarly, the vector DNA is also incubated with the same restriction endonuclease under optimal conditions. This results in the cutting of the DNA into fragments.
- (b) Gel electrophoresis is used to separate the DNA fragments produced by restriction digestion. The DNA fragments resolve according to their sizes, through the sieving effect provided by the agarose gel.
- (c) The resultant fragments are joined to the vector by use of DNA ligases, which form hydrogen bonds between their complementary cut counterparts.

OR

The main objective of the application of Biotechnology in agriculture is the production of pest-resistant crops; this would also reduce the quantity of pesticides/chemicals used and decrease environmental pollution. Bt toxins produced by the bacterium, *Bacillus thuringiensis*, kill certain insects like lepidopterans, dipterans, and coleopterans. Several nematode parasites attack a wide variety of plants. A novel strategy has been adopted to prevent this infestation in the tobacco plant.

- a) Write the scientific name of the nematode that parasitises tobacco plants**
- b) Write in full form the novel strategy used to control the nematode infestation in tobacco plants.**
- c) How does the novel strategy work?**
- d) Mention the source of the complementary dsDNA for the novel strategy.**
- e) Name the vector used for introducing the nematode-specific genes into the host tobacco plants.**

Ans:

- (a) *Meloidegyme incognita*
- (b) RNA interference
- (c) The complementary dsRNA binds to and prevents the translation of a specific mRNA, i.e., silencing of an mRNA.
- (d) The source of the dsRNA
 - (i) Infection by RNA viruses
 - (ii) Transposons that replicate via an RNA intermediate.
- (e) *Agrobacterium tumefaciens*

BioSmartNotes