

Sample Paper-2 (2023-24)
Class XII Biology Marking Scheme
(Subject Code-044)

Maximum Marks: 70

Time: 3 hours

SECTION-A

1. A dicotyledonous plant bears flowers but never produces fruits and seeds.

The most probable cause for the above situation is: 1

- a. The plant is dioecious and bears only pistillate flowers
- b. The plant is dioecious and bears both pistillate and staminate flowers
- c. The plant is monoecious
- d. The plant is dioecious and bears only staminate flowers.

Ans. d. The plant is dioecious and bears only staminate flowers.

2. Which one of the following is not a male accessory gland? 1

- a. Seminal vesicle
- b. Ampulla
- c. Prostate
- d. Bulbourethral gland

Ans. b. Ampulla

3. Conditions of a karyotype $2n + 1$, $2n - 1$ and $2n + 2$, $2n - 2$ are called: 1

- a. Aneuploidy
- b. Polyploidy
- c. Allopolyploidy
- d. Monosomy

Ans: a. Aneuploidy

4. In sickle cell anaemia glutamic acid is replaced by valine. Which one of the following triplets codes for valine? 1

- a. G G G
- b. A A G

c. G A A

d. G U G

Ans: d. G U G

5. $(p+q)^2 = p^2 + 2pq + q^2 = 1$ represents an equation used in: 1

a. population genetics

b. mendelian genetics

c. biometrics

d. molecular genetics

Ans: a. population genetics

6. Big holes in Swiss cheese are made by a: 1

a. machine

b. bacterium that produces methane gas

c. bacterium producing a large amount of carbon dioxide

d. fungus that releases a lot of gases during its metabolic activities.

Ans: c. bacterium producing a large amount of carbon dioxide

7. Activated sludge should have the ability to settle quickly so that it can: 1

a. be rapidly pumped back from sedimentation tank to aeration tank

b. absorb pathogenic bacteria present in wastewater while sinking to the bottom of the settling tank

c. be discarded and anaerobically digested

d. absorb colloidal organic matter.

Ans: a. be rapidly pumped back from sedimentation tank to aeration tank

8. The most important feature of a plasmid to serve as a vector in gene cloning experiment is: 1

a. Origin of replication (ori)

b. Presence of a selectable marker

c. Presence of sites for restriction endonuclease

d. Its size

Ans: a. Origin of replication (ori)

9. Who among the following was awarded the Nobel Prize for the development of PCR technique? 1

- a. Herbert Boyer
- b. Hargovind Khurana
- c. Kary Mullis
- d. Arthur Kornberg

Ans: c. Kary Mullis

10. The first clinical gene therapy was done for the treatment of: 1

- a. AIDS
- b. Cancer
- c. Cystic fibrosis
- d. SCID (Severe Combined Immuno Deficiency resulting from deficiency of ADA)

Ans. d. SCID (Severe Combined Immuno Deficiency resulting from deficiency of ADA)

11. Bt cotton is not: 1

- a. A GM plant
- b. Insect-resistant
- c. A bacterial gene expressing system
- d. Resistant to all pesticides

Ans. d. Resistant to all pesticides

12. A probe which is a molecule used to locate homologous sequences in a mixture of DNA or RNA molecules, could be: 1

- a. An ssRNA
- b. An ssDNA
- c. Either RNA or DNA
- d. Can be ssDNA but not ssRNA

Ans. c. Either RNA or DNA

Question No. 13 to 16 consist of two statements – Assertion (A) and Reason (R). Answer these questions by selecting the appropriate option given below:

- (a) Assertion and Reason are true and Reason is the correct explanation of Assertion.
(b) Assertion and Reason are true but Reason is not the correct explanation of Assertion.
(c) Assertion is true but Reason is false.
(d) Both Assertion and Reason are false.

13. **Assertion:** Human population now doubles every 35 years as against 200 years in 1600-1800. 1

Reason: Rapid increase is due to better health facilities and food resources.

Ans. A. Both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

14. **Assertion :** Biotic community has higher position than population in ecological hierarchy. 1

Reason : Population of similar individuals remains isolated in the community

Ans. (c) Assertion is true but Reason is false.

15. **Assertion :** Flora contains the actual account of habitat and distribution of plants of a given area.

Reason : Flora helps in correct identification. 1

Ans. (b) Assertion and Reason are true but Reason is not the correct explanation of Assertion.

16. **Assertion:** “The Biological Species” concept helps us to ask how species are formed.

Reason: The concept of biological species focuses our attention on the question of how reproductive isolation comes about.

1

Ans. (a) Assertion and Reason are true and Reason is the correct explanation of Assertion.

SECTION-B

17. Discuss why Drosophila has been used extensively for genetical studies. 2

Drosophila has been used extensively for genetical studies because

It could be grown in simple synthetic medium in the laboratory.

A single mating can produce a large number of progeny files

It's life cycle is short about 2 weeks.

18. How has the sequencing of the human genome opened new windows for the treatment of various genetic disorders? 2

The sequencing of the human genome opened new windows for the treatment of various genetic disorders because it led to a better knowledge of genetic disorders.

A better understanding on Diagnosis, treatment and prevention of genetic disorders is possible.

19. Discuss the significance of heavy isotope of nitrogen in the Meselson and Stahl's experiment. 2

A heavy isotope of nitrogen in the Meselson and Stahl's experiment showed that the DNA is of intermediate density between N^{14} and N^{15} .

This showed that the hybrid DNA has one strand of N^{14} and one strand of N^{15} showing DNA replication is semiconservative.

20. Why is nascent oxygen supported to be toxic to aerobic life forms? 2

Nascent oxygen is a highly reactive substance. It is a permanent oxidising agent.

It can easily react with various kinds of molecules like DNA, proteins present in aerobic life forms.

21. Give the scientific names of any two microorganisms inhabiting the human intestine. 2

The scientific names of two microorganisms inhabiting the human intestine are Escherichia coli and Lactobacillus.

SECTION-C

22. Name the male accessory glands. What is seminal plasma? What are its constituents? 3

- 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.
- The secretions of bulbourethral glands also help in the lubrication of the penis.

OR

Describe the external genitalia of human female.

The female external genitalia include mons pubis, labia majora, labia minora, hymen and clitoris.

- **Mons pubis** is a cushion of fatty tissue covered by skin and pubic hair.
- The **labia majora** are fleshy folds of tissue, which extend down from the mons pubis and surround the vaginal opening.
- The **labia minora** are paired folds of tissue under the labia majora.
- The opening of the vagina is often covered partially by a membrane called **hymen**.
- The **clitoris** is a tiny finger-like structure which lies at the upper junction of the two labia minora above the urethral opening.

23. How do genes and chromosomes share similarity from genetical studies? 3

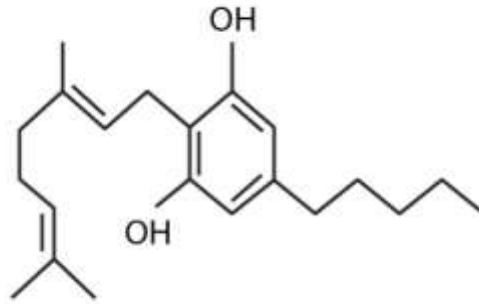
1. It both occurs in pair
2. At the time of the formation of gamete, genes and chromosome separate and one of each pair is transmitted to a gamete.
3. The pairs will independently separate each other.

24. State and explain any three factors affecting allele frequency in populations. 3

1. Gene migration or gene flow – it is the movement of alleles into a gene pool or out of a gene pool.
2. Genetic drift – If the movement of alleles into a gene pool or out of a gene pool takes place by chance is called Genetic Drift.
3. Mutation – It is the large difference arising suddenly in a population, they are random and occur in all directions.

25. The outline structure of a drug is given below. 3

- a. Which group of drugs does this represent?
- b. What are the modes of consumption of these drugs?
- c. Name the organ of the body which is affected by the consumption of these drugs.



- It belongs to the Cannabinoids group of drugs.
- This drug can be consumed either orally or by inhalation.
- The cardiovascular system of the body is most affected.

26. What is an ecosystem service? List any four important ecosystem services provided by natural ecosystems. 3

The services that are provided by the ecosystem are called ecosystem services. Four important ecosystem services are

Purification of air and water

Mitigate droughts and floods

Provides habitat and food to the wildlife.

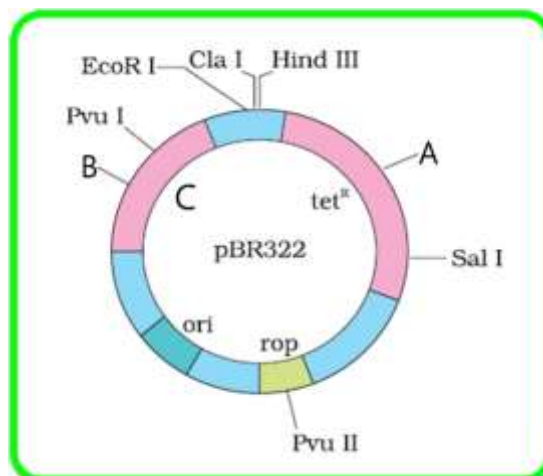
Maintain biodiversity

Pollinate crops

Provide storage site for carbon

Provide aesthetic pleasure, cultural and spiritual values

27. Name the cloning sites marked as A, B and C in the following plasmid. 3



A- Bam HI : Bacillus amyloliquefaciens (H is a strain)

B- Pst I : Providencia stuartii

C- ampR : Ampicillin Resistance

28. What is origin of replication? What is its importance? 3

Origin of replication is a specific DNA sequence in a chromosome, which is responsible for initiating replication

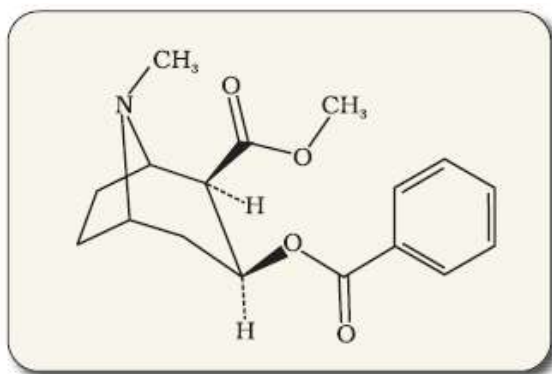
Any piece of DNA when linked to this sequence can be made to replicate within the host cells.

This sequence is also responsible for **controlling the copy number** of the linked DNA.

So, if one wants to recover many copies of the target DNA it should be cloned in a vector whose origin support high copy number.

SECTION-D

29. Observe the given figure and answer the following questions. 4



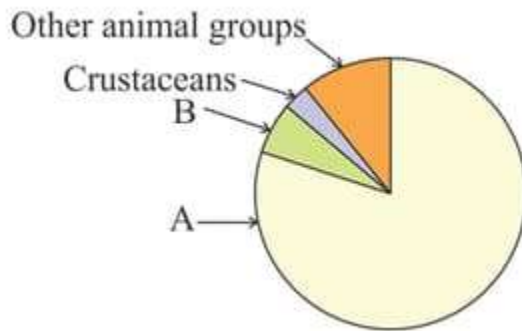
- (a) Identify the drug shown by the above structure.
- (b) Name the drugs, which are commonly abused are opioids, cannabinoids and coca alkaloids.
- (c) Name any two drugs or secondary metabolites of plants that are used as medicines.

- (a) Morphine 1
- (b) The drugs, which are commonly abused are opioids, cannabinoids and coca alkaloids. 1
- (c) 2

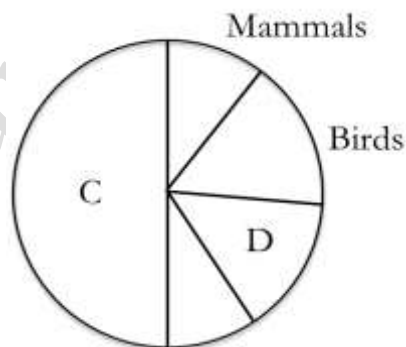
Drugs	Medicinal Use
Atropine	Dilating pupil of eye during eye test

Belladonna	Diuretic and Antispasmodic
Morphine	Sedative and painkiller used during surgery
Barbiturates, amphetamines, benzodiazepines, lysergic acid diethyl amides	Treating depression and insomnia

30. (a) The given pie diagram represents the proportionate number of species of major groups of invertebrates. Identify groups A and B. 4



(b) The given pie diagram represents the proportionate number of species of major groups of vertebrates. Identify groups C and D.



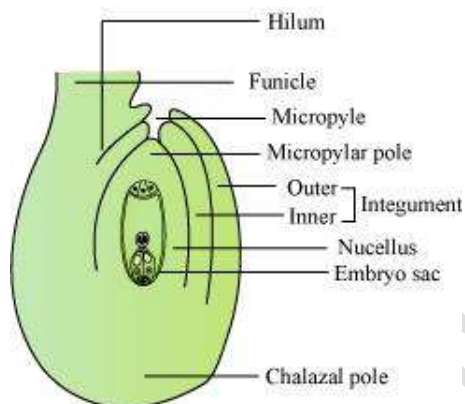
(c) How many species of plants and animals have been recorded from India.

- (a) A-Insects, B-Molluscs 1
- (b) C-Fishes, D-Reptiles 1
- (c) Nearly **45,000 species** of plants and **twice** as many of animals have been recorded from India. 2

SECTION-E

31. With a neat, labelled diagram, describe the parts of a typical angiosperm ovule. 5

An ovule is a female megasporangium where the formation of megaspores takes place.



The various parts of an ovule are –

No	Part	Description
1	Funicle	It is a stalk-like structure which attaches the ovule to the placenta of the ovary.
2	Hilum	It is the point of attachment of ovule to the funicle
3	Integuments	They are the outer layers surrounding the ovule that provide protection to the developing embryo.
4	Micropyle	It is a narrow pore formed by the projection of integuments.
		It marks the point where the pollen tube enters the ovule at the time of fertilization.
5	Nucellus	It is a mass of the parenchymatous tissue surrounded by the integuments from the outside.
		The nucellus provides nutrition to the developing embryo.
		The embryo sac is located inside the nucellus.
6	Chalaza	It is the basal swollen part of the nucellus from where the integuments originate.

OR

11. (a) If the meiocyte of a maize plant contains 20 chromosomes, write the number of chromosomes in the endosperm and embryo of the maize grain and give reasons in support of your answer.
- (b) Describe the development of a dicot embryo in a viable seed.
- (c) Why certain angiospermic seeds are albuminous while others are exalbuminous? Explain.

(a) If the meiocyte of a maize plant contains 20 chromosomes, then $2n=20$.

Haploid chromosome is $n=10$

Number of chromosomes in endosperm:

Number of chromosomes in endosperm is 30 because endosperm is triploid $3n=30$.

Number of chromosomes in embryo:

Number of chromosomes in embryo is 20 because endosperm is diploid $2n=20$.

Development of dicot embryo:

- (b) Zygote divides mitotically to give rise to proembryo, globular and heart shaped, mature embryo.
- (c) **Albuminous Seeds** – Seeds in which endosperm is not completely used up during embryo development / residual endosperm found in the seed.

Exalbuminous Seeds - Seeds in which endosperm is completely consumed / no residual endosperm is left in seed.

32. (a) Males in whom testes fail to descend to the scrotum are generally infertile. Why? 5

(b) Mention two advantages of lactational amenorrhea as a contraceptive method.

(c) Draw a diagrammatic sectional view of an enlarged seminiferous tubule

(a) Spermatogenesis requires $2-3^{\circ}\text{C}$ less temperature as compared to the body temperatures (37°C)

If the testes do not descend into the scrotum before adolescence, they will stop producing sperms.

This leads to inhibition of spermatogenesis and hence causes infertility.

(b) Advantages of lactational amenorrhea as a contraceptive method.

1. It acts as a natural contraceptive method.
2. There is no ovulation and menstruation during this period.

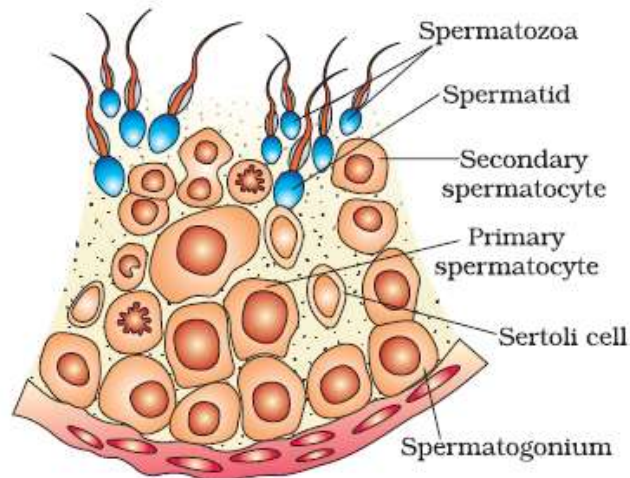


Figure 3.5 Diagrammatic sectional view of a seminiferous tubule (enlarged)

OR

Answer the following questions based on medical termination of pregnancy.

- (a) What is medical termination of pregnancy? Why is it done?**
- (b) Which period is safe for MTP?**
- (c) What are the dangerous or unhealthy trends of MTP?**
- (d) Draw a diagram showing section of ovary.**

(a) Intentional or voluntary termination of pregnancy before full term is called medical termination of pregnancy (MTP) or induced abortion.

MTP is performed to get rid of unwanted pregnancies either due to casual unprotected intercourse or failure of the contraceptive used during coitus or rapes.

MTPs are also essential, where continuation of the pregnancy could be harmful or even fatal either to the mother or to the foetus or both.

(b) MTPs are considered **safe during the first trimester**, i.e., upto 12 weeks of pregnancy. **Second trimester abortions are much riskier.**

(c) Most of the MTPs are performed illegally by unqualified quacks which are not only unsafe but could be fatal too.

MTPs performed when the foetus is found to be female is illegal.

Such practices should be avoided because these are dangerous both for the young mother and the foetus.

(d) Diagram of ovary.

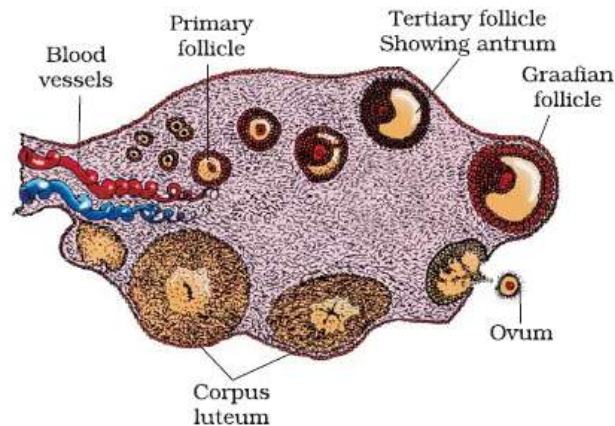


Figure 3.7 Diagrammatic Section view of ovary

33. Explain the process of transcription in prokaryotes with a neat and labelled diagram.

OR

During evolution why DNA was chosen over RNA as genetic material? Give reasons by first mentioning the desired criteria in a molecule that can act as genetic material and in the light of biochemical differences between DNA and RNA.

5

Transcription in Prokaryotes

Transcription is the process of synthesis of RNA from DNA template. A segment of DNA gets copied into mRNA during the process.

The process of transcription starts at the promoter region of the template DNA and terminates at the terminator region.

The segment of DNA between these two regions is known as transcription unit.

The transcription requires RNA polymerase enzyme, a DNA template, four types of ribonucleotides, and certain cofactors such as Mg^{2+} .

The three important events that occur during the process of transcription are as follows.

- (i) Initiation
- (ii) Elongation
- (iii) Termination

Initiation:

The DNA dependent RNA polymerase binds to the promoter along with the sigma factor and begins transcription. This is known as initiation.

A single RNA polymerase catalyzes the transcription of all types of RNAs in bacteria.

Elongation:

RNA polymerase keeps adding nucleotides (polymerization) following the rule of complementarity. The length of mRNA keeps increasing.

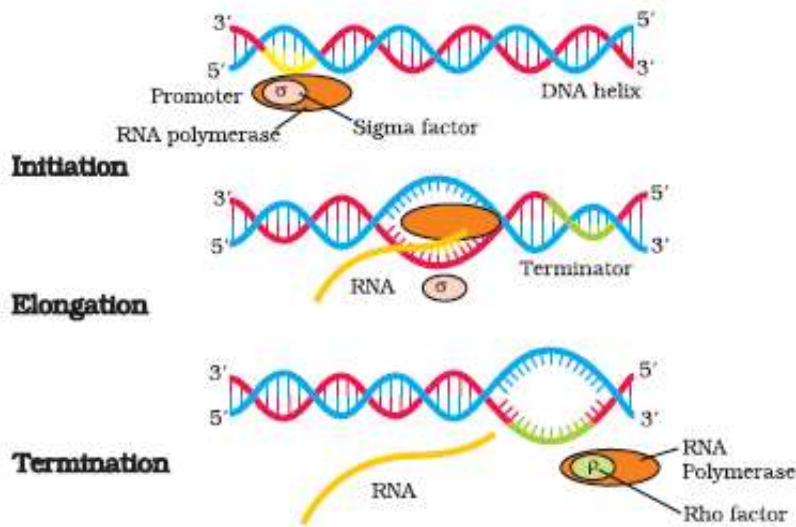
Termination:

When polymerase reaches the terminator region, the Rho factor combines with the polymerase and terminates transcription.

The RNA polymerase and the mRNA get separated.

The RNA polymerase is only capable of catalyzing the process of elongation.

But it starts transcription by joining with the **initiation-factor** (σ) and stops transcription by joining with **termination-factor** (ρ).



OR

The desired criteria in a molecule that can act as genetic material are

1. It should be chemically and structurally stable.
2. It should be able to replicate so that replication should take place.
3. Mutation or gradual and slow changes should take place.
4. It should be able to express itself in Mendelian.
5. It should be transferred from parent to progeny for further evolution.

The biochemical difference between DNA and RNA are

- i. DNA is less reactive and more stable chemically and structurally whereas RNA is more reactive and less stable chemically and structurally.
- ii. Thymine in the place of Uracil also makes stability in DNA whereas the Uracil in the place of Thymine will decrease the stability of RNA
- iii. Slow mutation takes place in DNA whereas, in RNA, rapid mutations take place
- iv. DNA is double-stranded and RNA is single-stranded

These biochemical differences between the DNA and RNA make DNA a desired genetic material.
