

Biology Question Paper With Solutions

1. Who performed experiments on *Vicia faba* to prove that the DNA replicates semi-conservatively?

- (1) Taylor and colleagues**
- (2) Matthew Meselson**
- (3) Stahl**
- (4) Hershey and Chase**

Correct Answer: (1) Taylor and colleagues

Solution: Taylor and his colleagues used root tips of *Vicia faba* (broad bean) to demonstrate that DNA replication follows a semi-conservative mechanism. In this method, each daughter DNA molecule consists of one original (parental) strand and one newly synthesized strand. This experiment laid the foundation for understanding how genetic information is conserved during cell division.

Quick Tip

For DNA replication experiment questions, remember that Taylor's experiments involved plant cells like *Vicia faba*, while Meselson and Stahl worked with bacterial cells like *E. coli*.

2. A thermostable DNA polymerase is isolated from:

- (1) *Thermus aquaticus***
- (2) *Agrobacterium tumefaciens***
- (3) *E. coli***
- (4) *Salmonella typhimurium***

Correct Answer: (1) *Thermus aquaticus*

Solution: The thermostable DNA polymerase, known as Taq polymerase, is isolated from *Thermus aquaticus*, a bacterium found in hot springs. Taq polymerase remains stable at high temperatures, making it ideal for use in Polymerase Chain Reaction (PCR) techniques where repeated cycles of heating are needed to denature DNA. This enzyme's discovery revolutionized molecular biology by enabling rapid DNA amplification.

Quick Tip

In questions about PCR enzymes, remember Taq polymerase from *Thermus aquaticus* is crucial because of its heat stability.

3. ELISA is based on the principle of:

- (1) Antigen – Antigen interaction**
- (2) B-cells and T-cells interaction**
- (3) Antigen – Antibody interaction**
- (4) T-cell – Antibody interaction**

Correct Answer: (3) Antigen – Antibody interaction

Solution: ELISA (Enzyme-Linked Immunosorbent Assay) is a biochemical technique used mainly in immunology to detect the presence of an antibody or antigen in a sample. This technique is based on the specific binding between an antigen and an antibody, which allows for highly specific detection of substances. In ELISA, enzymes linked to antibodies produce a detectable signal, usually colorimetric, which indicates the presence of the target molecule.

Quick Tip

Remember: ELISA is commonly used for HIV testing and relies on antigen-antibody interactions to provide results.

4. Which of the following represents a test cross in which half the offspring is heterozygous and half would be homozygous recessive?

- (1) $TT \times tt$
- (2) $Tt \times tt$
- (3) $Tt \times Tt$
- (4) $tt \times tt$

Correct Answer: (2) $Tt \times tt$

Solution: A test cross is used to determine the genotype of an individual showing a dominant trait. When a heterozygous (Tt) individual is crossed with a homozygous recessive (tt) individual, the offspring will show a 1:1 ratio. Half of the progeny will be heterozygous (Tt), displaying the dominant trait, and the other half will be homozygous recessive (tt), showing the recessive trait.

Quick Tip

For test crosses, crossing a heterozygous with a homozygous recessive individual will reveal if the trait is dominant or recessive.

5. In which phase of the cell cycle does replication of DNA take place?

- (1) G1 phase
- (2) M phase
- (3) S phase

(4) G2 phase

Correct Answer: (3) S phase

Solution: DNA replication occurs during the S (Synthesis) phase of the cell cycle. During this phase, each chromosome is replicated to form two sister chromatids, which will be separated during mitosis. The S phase ensures that each daughter cell receives an exact copy of the DNA.

Quick Tip

Remember: DNA replication occurs only during the S phase, not during G1 or G2.

6. In Hershey and Chase experiment, some viruses grew on medium that contained:

- (1) $^{35}\text{S}, ^{32}\text{P}$
- (2) $^{36}\text{S}, ^{34}\text{P}$
- (3) $^{32}\text{S}, ^{36}\text{P}$
- (4) $^{34}\text{S}, ^{36}\text{P}$

Correct Answer: (1) $^{35}\text{S}, ^{32}\text{P}$

Solution: In the Hershey and Chase experiment, ^{35}S was used to label the protein coat of the bacteriophage, while ^{32}P was used to label its DNA. This experiment demonstrated that DNA, not protein, is the genetic material, as only the ^{32}P -labeled DNA entered the bacterial cells, while the ^{35}S -labeled protein remained outside.

Quick Tip

Remember: ^{32}P labels DNA, and ^{35}S labels proteins in molecular experiments.

7. Which one of the following is not a process of DNA recombinant technology?

- (1) Isolation of DNA**
- (2) RNA interference (RNAi)**
- (3) Introduction of Restriction endonucleases**
- (4) Culturing the host cells in a medium at a large scale**

Correct Answer: (2) RNA interference (RNAi)

Solution: RNA interference (RNAi) is a biological process where RNA molecules inhibit gene expression or translation by neutralizing targeted mRNA molecules. This is not a standard part of recombinant DNA technology, which typically involves isolating DNA, using restriction enzymes, and culturing modified cells.

Quick Tip

In recombinant DNA technology, look for DNA manipulation and culturing steps, not RNA interference.

8. Which of the following gas is found in the Stratosphere?

- (1) Ozone**
- (2) Carbon dioxide**
- (3) Methane**
- (4) Hydrogen**

Correct Answer: (1) Ozone

Solution: The ozone layer, which absorbs most of the sun's harmful ultraviolet radiation, is located in the stratosphere. Ozone (O₃) plays a crucial role in protecting life on Earth by preventing excessive UV radiation from reaching the surface.

Quick Tip

Remember: Ozone is concentrated in the stratosphere, where it forms the protective ozone layer.

9. In which of the following units is thickness of ozone layer measured?

- (1) Dobson
- (2) Joule
- (3) Newton
- (4) Decibel

Correct Answer: (1) Dobson

Solution: The thickness of the ozone layer is measured in Dobson units (DU). This unit quantifies the total amount of ozone in a column of the atmosphere and is named after G.M.B. Dobson, a researcher who extensively studied atmospheric ozone.

Quick Tip

Remember: Dobson units (DU) are specific to ozone measurement.

10. Ex-situ conservation includes:

- (1) Biosphere reserves
- (2) National parks
- (3) Wildlife sanctuaries
- (4) Seed banks

Correct Answer: (4) Seed banks

Solution: Ex-situ conservation refers to the preservation of species outside their natural habi-

tats. Examples include seed banks, botanical gardens, and zoos, where biological resources are stored or grown in controlled environments for conservation and research.

Quick Tip

Ex-situ conservation happens outside the natural environment; in-situ is within it.

11. In a velvet grass seed, the cotyledon is called:

- (1) Scutellum
- (2) Coleorrhiza
- (3) Coleoptile
- (4) Testa

Correct Answer: (1) Scutellum

Solution: In grasses like velvet grass, the cotyledon is termed the scutellum. It is a specialized structure that facilitates nutrient transfer from the endosperm to the developing embryo in monocot seeds.

Quick Tip

In monocots, remember that the cotyledon is called the scutellum.

12. Which of the following is a recessive trait for garden pea plant?

- (1) Round seed
- (2) Constricted pod
- (3) Tall plant
- (4) Violet flower

Correct Answer: (2) Constricted pod

Solution: In Mendel's experiments, constricted pods were identified as a recessive trait in pea plants. Traits such as round seeds and tall plants were dominant, while traits like wrinkled seeds and constricted pods were recessive.

Quick Tip

Dominant traits include round seeds and tall plants; constricted pods are recessive.

13. Nucleosome is:

- (1) Positively charged DNA wrapped around negatively charged histone octamer**
- (2) Negatively charged DNA wrapped around positively charged histone octamer**
- (3) Positively charged DNA wrapped around positively charged histone octamer**
- (4) Negatively charged DNA wrapped around negatively charged histone octamer**

Correct Answer: (2) Negatively charged DNA wrapped around positively charged histone octamer

Solution: Nucleosomes are the fundamental units of chromatin, where negatively charged DNA is wrapped around a positively charged histone protein octamer. This structure helps in compacting DNA within the nucleus.

Quick Tip

DNA is negatively charged, while histones are positively charged, allowing them to bind.

14. "Transforming Principle" was given by:

- (1) Maclyn McCarty**

- (2) Frederick Griffith
- (3) Alfred Hershey
- (4) Watson and Crick

Correct Answer: (2) Frederick Griffith

Solution: Frederick Griffith discovered the "Transforming Principle" in 1928 through his experiments with *Streptococcus pneumoniae*. He observed that non-virulent strains could be transformed into virulent strains when exposed to heat-killed virulent cells, indicating the presence of a transferable genetic material.

Quick Tip

Griffith's experiments led to the concept of genetic transformation.

15. Which disorder is caused by the substitution of Glutamic acid (Glu) by Valine (Val) at the sixth position of the beta globin chain of the hemoglobin?

- (1) Phenylketonuria
- (2) Sickle-cell Anemia
- (3) Hemophilia
- (4) Thalassemia

Correct Answer: (2) Sickle-cell Anemia

Solution: Sickle-cell anemia is a genetic disorder caused by a point mutation in the hemoglobin-beta gene. This mutation leads to the substitution of Glutamic acid (Glu) with Valine (Val) at the sixth position of the beta globin chain. This single amino acid change causes hemoglobin to form fibers, leading to the characteristic sickle shape of red blood cells.

Quick Tip

Remember: A single point mutation can have severe consequences, as seen in sickle-cell anemia.

16. Arrange the following steps of DNA fingerprinting in proper sequence:

- (A) Hybridization using labeled VNTR probe**
- (B) Separation of DNA fragments by electrophoresis**
- (C) Digestion of DNA by restriction endonucleases**
- (D) Blotting of separated DNA fragments to nylon**
- (E) Isolation of DNA**

Choose the correct answer from the options given below:

- (1) (C), (A), (B), (D), (E)**
- (2) (E), (C), (B), (D), (A)**
- (3) (B), (C), (D), (E), (A)**
- (4) (C), (D), (B), (A), (E)**

Correct Answer: (2) (E), (C), (B), (D), (A)

Solution: The correct order for DNA fingerprinting is: (E) Isolation of DNA, (C) Digestion by restriction endonucleases, (B) Separation by electrophoresis, (D) Blotting to nylon membrane, and (A) Hybridization with a labeled probe. DNA fingerprinting is a powerful technique used for identification based on DNA variations.

Quick Tip

Memorize the sequence for DNA fingerprinting: Isolation, Digestion, Separation, Blotting, Hybridization.

17. Match List-I with List-II:

List-I (Disease)	List-II (Pathogen/Genera)
(A) Amoebiasis	(I) Wuchereria
(B) Filariasis	(II) Entamoeba histolytica
(C) Ringworm	(III) Haemophilus influenzae
(D) Pneumonia	(IV) Epidermophyton

Choose the correct answer from the options given below:

- (1) (A) - (III), (B) - (I), (C) - (IV), (D) - (II)
- (2) (A) - (II), (B) - (I), (C) - (IV), (D) - (III)
- (3) (A) - (II), (B) - (III), (C) - (IV), (D) - (I)
- (4) (A) - (II), (B) - (IV), (C) - (III), (D) - (I)

Correct Answer: (2) (A) - (II), (B) - (I), (C) - (IV), (D) - (III)

Solution: The correct matches are: (A) Amoebiasis - *Entamoeba histolytica*, (B) Filariasis - *Wuchereria*, (C) Ringworm - *Epidermophyton*, and (D) Pneumonia - *Haemophilus influenzae*. Knowing the pathogens responsible for various diseases is crucial for understanding infectious diseases.

Quick Tip

Use associations like Amoebiasis with *Entamoeba* and Filariasis with *Wuchereria* for quick recall.

18. Streptokinase enzyme is used for:

- (1) Removing clot from blood vessels
- (2) Clarifying fruit juices
- (3) Synthesis of cholesterol
- (4) Removing oily stains

Correct Answer: (1) Removing clot from blood vessels

Solution: Streptokinase is an enzyme produced by certain streptococcal bacteria. It acts as a clot buster by converting plasminogen to plasmin, which dissolves blood clots. It is widely used in medical treatments for myocardial infarctions (heart attacks) and other blood clot-related conditions.

Quick Tip

Streptokinase breaks down blood clots, especially in emergency heart treatments.

19. Select the incorrect statement:

- (1) Chromosome 1 has the most genes and chromosome Y has the fewest.
- (2) Chromosome 21 has the most genes and chromosome Y has the fewest.
- (3) Less than 2 percent of the genome codes for proteins.
- (4) The functions of over 50 percent of discovered genes are unknown.

Correct Answer: (2) Chromosome 21 has the most genes and chromosome Y has the fewest.

Solution: Chromosome 1 contains the most genes, whereas chromosome Y has the fewest. Chromosome 21 has one of the fewest gene counts among human chromosomes. The statement that chromosome 21 has the most genes is incorrect.

Quick Tip

Chromosome 1 has the highest gene count, while the Y chromosome has the least.

20. Which of the following is not a step of Polymerase Chain Reaction?

- (1) Extension
- (2) Downstream processing

(3) Annealing

(4) Denaturation

Correct Answer: (2) Downstream processing

Solution: PCR includes three main steps: denaturation, annealing, and extension. Downstream processing is a term typically associated with post-synthesis procedures in biotechnology, such as purification, and is not part of the PCR cycle.

Quick Tip

PCR involves denaturation, annealing, and extension—downstream processing comes after.

21. Which of the following equation is correct about Verhulst-Pearl Logistic Growth?

(1) $\frac{dN}{dt} = (h - d) \frac{K-N}{K}$

(2) $\frac{dN}{dt} = rN \frac{N-K}{K}$

(3) $\frac{dN}{dt} = rN \frac{K-N}{K}$

(4) $\frac{dN}{dt} = (h - d) \frac{N-K}{K}$

Correct Answer: (3) $\frac{dN}{dt} = rN \frac{K-N}{K}$

Solution: The Verhulst-Pearl logistic growth model describes population growth where resources are limited. The correct equation for logistic growth is $\frac{dN}{dt} = rN \frac{K-N}{K}$, where N is the population size, r is the intrinsic growth rate, and K is the carrying capacity. This equation predicts an S-shaped growth curve as the population approaches K .

Quick Tip

In logistic growth equations, the term $\frac{K-N}{K}$ limits growth as N approaches K .

22. Match List-I with List-II:

List-I (Genes)	List-II (Proteins – Codes for lac operon)
(A) <i>i</i>	(I) permease
(B) <i>a</i>	(II) β -galactosidase
(C) <i>y</i>	(III) transacetylase
(D) <i>z</i>	(IV) repressor

Choose the correct answer from the options given below:

- (1) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)
- (2) (A) - (IV), (B) - (III), (C) - (I), (D) - (II)
- (3) (A) - (II), (B) - (III), (C) - (IV), (D) - (I)
- (4) (A) - (IV), (B) - (II), (C) - (III), (D) - (I)

Correct Answer: (2) (A) - (IV), (B) - (III), (C) - (I), (D) - (II)

Solution: In the lac operon, gene *i* codes for the repressor protein, gene *a* codes for transacetylase, gene *y* codes for permease, and gene *z* codes for β -galactosidase. This operon is a classic example of gene regulation in prokaryotes.

Quick Tip

Remember the lac operon genes: *z* for β -galactosidase, *y* for permease, *a* for transacetylase, and *i* for repressor.

23. Analogous structures are a result of:

- (1) Divergent evolution
- (2) Convergent evolution
- (3) Genetic drift
- (4) Point mutations

Correct Answer: (2) Convergent evolution

Solution: Analogous structures arise from convergent evolution, where unrelated species develop similar traits due to adapting to similar environments. For example, the wings of birds and insects are analogous; they serve the same function but have different evolutionary origins.

Quick Tip

Analogous structures are due to convergent evolution; homologous structures result from divergent evolution.

24. Amino acid is attached to which site of tRNA?

- (1) Anticodon loop
- (2) 3' end
- (3) 5' end
- (4) D-loop

Correct Answer: (2) 3' end

Solution: The amino acid attaches to the 3' end of the tRNA molecule. This site carries a CCA sequence where the specific amino acid binds, allowing tRNA to deliver the correct amino acid during protein synthesis.

Quick Tip

Remember: Amino acids bind to the 3' end of tRNA, while anticodons are located on the anticodon loop.

25. Which one of the following lymphoid organs is large at birth but reduces with age?

- (1) Bone marrow
- (2) Thymus
- (3) Spleen
- (4) Peyer's patches

Correct Answer: (2) Thymus

Solution: The thymus is a lymphoid organ that is relatively large at birth and plays a crucial role in immune function by maturing T-cells. However, it gradually decreases in size and activity after puberty, a process known as thymic involution.

Quick Tip

The thymus shrinks with age; it's most active during childhood.

26. Which of the following plays a significant role in our stomach in checking disease-causing microbes?

- (1) *Penicillium notatum*
- (2) *Monascus purpureus*
- (3) *Trichoderma polysporum*
- (4) *Lactobacillus*

Correct Answer: (4) Lactobacillus

Solution: *Lactobacillus* is a type of beneficial bacteria that inhabits our gut and plays a role in maintaining a healthy digestive system. It helps in keeping disease-causing microbes in check by producing lactic acid and maintaining an acidic environment.

Quick Tip

Lactobacillus is essential for gut health, especially in producing lactic acid that inhibits pathogens.

27. Given below are two statements:

Statement I: Whisky, brandy, and rum are produced without distillation of the fermented broth.

Statement II: *Saccharomyces cerevisiae* is called doctor's yeast.

Choose the correct answer from the options below:

- (1) Both Statement I and Statement II are true
- (2) Both Statement I and Statement II are false
- (3) Statement I is true, but Statement II is false
- (4) Statement I is false, but Statement II is true

Correct Answer: (4) Statement I is false, but Statement II is true

Solution: Whisky, brandy, and rum are produced through the distillation of fermented broth, not without it. *Saccharomyces cerevisiae*, also known as baker's or doctor's yeast, is used in alcohol fermentation and baking.

Quick Tip

Distilled alcoholic drinks include whisky, brandy, and rum, which undergo fermentation and distillation.

28. Given below is the DNA coding sequence. Its complementary strand would read as:

5' – GTATTACG – 3'

- (1) 5' – CUTUUTGC – 3'
- (2) 3' – CATAATGC – 5'
- (3) 3' – CUTUUTGC – 5'
- (4) 5' – CTUTTUGC – 3'

Correct Answer: (2) 3' – CATAATGC – 5'

Solution: The complementary strand of DNA is formed by pairing A with T and G with C. Thus, the sequence 5' – GTATTACG – 3' pairs with 3' – CATAATGC – 5'.

Quick Tip

In DNA, A pairs with T and G pairs with C.

29. Which of the following statements is not correct for Restriction enzymes?

- (1) Exonucleases remove nucleotides from ends of the DNA.
- (2) Endonucleases make cuts at specific positions within the DNA.
- (3) Ligases join sticky ends of DNA together.
- (4) The first restriction endonuclease was Hind II.

Correct Answer: (4) The first restriction endonuclease was Hind II.

Solution: The first discovered restriction enzyme was EcoRI, not Hind II. Exonucleases and endonucleases have different roles in DNA processing. Ligases join DNA fragments, especially during molecular cloning.

Quick Tip

Remember: EcoRI was the first restriction enzyme discovered, not Hind II.

30. Match List-I with List-II:

List-I (Recent Extinction)	List-II (Place)
(A) Dodo	(I) Africa
(B) Quagga	(II) Russia
(C) Thylacine	(III) Mauritius
(D) Steller's Sea Cow	(IV) Australia

Choose the correct answer from the options given below:

- (1) (A) - (I), (B) - (III), (C) - (II), (D) - (IV)
- (2) (A) - (II), (B) - (III), (C) - (IV), (D) - (I)
- (3) (A) - (III), (B) - (I), (C) - (IV), (D) - (II)
- (4) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

Correct Answer: (1) (A) - (I), (B) - (III), (C) - (II), (D) - (IV)

Solution: The Dodo went extinct in Mauritius, the Quagga in Africa, the Thylacine in Australia, and the Steller's Sea Cow in Russia.

Quick Tip

Use mnemonics to remember the places of these extinctions, like "Dodo in Mauritius."

31. Which one of the following is not associated with megasporangium?

- (1) Funicle
- (2) Integument
- (3) Generative cell
- (4) Micropyle

Correct Answer: (3) Generative cell

Solution: The megasporangium, also known as the ovule in seed plants, is surrounded by the integuments, has a micropyle (small opening for pollen entry), and is connected to the ovary wall via the funicle. The generative cell, however, is associated with pollen grain development

and not with the megasporangium.

Quick Tip

Remember: The generative cell is part of the pollen grain, not the megasporangium.

Read the following passage and answer the next five questions:

The reproductive cycle of female primates is called the menstrual cycle. Menstrual cycle starts only after attaining sexual maturation (puberty). Generally, during ovulation only one ovum is released per menstrual cycle. The cyclical changes in the ovary and the uterus during menstrual cycle are induced by changes in the levels of pituitary and ovarian hormones. After coitus, sperms are transported to the junction of the isthmus and ampulla, where the sperm fertilises the ovum leading to formation of a diploid zygote.

32. Which of the following does not constitute accessory duct of female reproductive system?

- (1) Fallopian tubes
- (2) Uterus
- (3) Cervix
- (4) Vagina

Correct Answer: (2) Uterus

Solution: Accessory ducts in the female reproductive system include the Fallopian tubes, cervix, and vagina, which help transport gametes and support fertilization. The uterus, however, serves as the site for embryo implantation and fetal development rather than acting as an accessory duct.

Quick Tip

Accessory ducts include the Fallopian tubes, cervix, and vagina, but not the uterus.

33. The female external genitalia include:

- (A) Mons pubis
- (B) Hymen
- (C) Mammary ducts
- (D) Clitoris
- (E) Cervix

Choose the correct answer from the options given below:

- (1) (A), (C) and (D) only
- (2) (B), (D) and (E) only
- (3) (A), (B) and (D) only
- (4) (C), (D) and (E) only

Correct Answer: (3) (A), (B) and (D) only

Solution: The female external genitalia, collectively known as the vulva, include the mons pubis, hymen, clitoris, and labia. Mammary ducts are part of the mammary glands and are associated with lactation, not the external genitalia. The cervix is an internal structure connecting the uterus to the vagina.

Quick Tip

The mons pubis, hymen, and clitoris are part of the external genitalia, not the cervix or mammary ducts.

34. Select the organ of the female reproductive system where the sperm is not trans-

ported at the time of coitus:

- (1) Cervix
- (2) Ovary
- (3) Uterus
- (4) Fallopian tube

Correct Answer: (2) Ovary

Solution: During coitus, sperm is deposited in the vagina and travels through the cervix, uterus, and into the Fallopian tubes. The ovary is not directly involved in this pathway, as it is the site of egg release, not sperm transport.

Quick Tip

Sperm travels through the cervix, uterus, and Fallopian tubes, but not the ovary.

35. Which of the following does not take place before ovulation in human females?

- (1) The secretion of LH and FSH increases during the follicular phase.
- (2) The corpus luteum secretes large amounts of progesterone.
- (3) LH and FSH attain peak levels in the middle of the cycle.
- (4) Maximum secretion of LH induces rupture of the Graafian follicle.

Correct Answer: (2) The corpus luteum secretes large amounts of progesterone.

Solution: Progesterone is primarily secreted by the corpus luteum after ovulation. During the follicular phase (before ovulation), estrogen is the predominant hormone, while LH and FSH levels peak just before ovulation to stimulate follicle rupture.

Quick Tip

Progesterone secretion mainly occurs after ovulation due to the corpus luteum.

36. Match List-I with List-II:

List-I (Phase of menstrual cycle)	List-II (Days of menstrual cycle)
(A) Proliferative phase	(I) 14th day
(B) Menstrual phase	(II) 15th–28th/29th days
(C) Secretory phase	(III) 1st–5th days
(D) Ovulatory phase	(IV) 5th–13th days

Choose the correct answer from the options given below:

- (1) (A) - (II), (B) - (IV), (C) - (III), (D) - (I)
- (2) (A) - (III), (B) - (II), (C) - (I), (D) - (IV)
- (3) (A) - (IV), (B) - (III), (C) - (II), (D) - (I)
- (4) (A) - (II), (B) - (IV), (C) - (I), (D) - (III)

Correct Answer: (3) (A) - (IV), (B) - (III), (C) - (II), (D) - (I)

Solution: The correct matches are as follows: Proliferative phase (5th–13th days), Menstrual phase (1st–5th days), Secretory phase (15th–28th days), and Ovulatory phase (14th day). These phases correspond to different hormonal and structural changes in the menstrual cycle.

Quick Tip

Memorize the sequence of menstrual cycle phases and corresponding days for quick recall.

Read the following passage and answer the next five questions:

In nature, populations of different species in a habitat do not live in isolation but interact in many ways. Depending on the outcome, these interactions between two species are classified as competition, predation, parasitism, commensalism, amen-

salism, and mutualism. Through these interactions, trophic energy transfer is facilitated. Some predators help in controlling their prey populations, whereas plants have evolved diverse morphological and chemical defenses against herbivores.

37. Name the population interaction which takes place when one species is benefited and another species has no effect (no benefit, no harm).

- (1) Competition
- (2) Predation
- (3) Commensalism
- (4) Amensalism

Correct Answer: (3) Commensalism

Solution: Commensalism is a type of interaction where one species benefits while the other species is neither helped nor harmed. This interaction is common in nature and can be seen in relationships such as barnacles attaching to whales, where the barnacle benefits from movement to new food sources, but the whale is unaffected.

Quick Tip

In commensalism, one species benefits while the other is unaffected (no benefit, no harm).

38. Identify the incorrect matching from the following population interactions:

Species A	Species B	Name of Interaction
+	+	Mutualism
+	–	Parasitism
–	–	Predation
–	0	Amensalism

Options:

- (1) Mutualism
- (2) Parasitism
- (3) Predation
- (4) Amensalism

Correct Answer: (3) Predation

Solution: Predation involves a $+/-$ interaction, where one species (the predator) benefits by feeding on the other species (the prey), which is harmed. A $-/-$ interaction is incorrect for predation, as both species are not negatively impacted in a predator-prey relationship.

Quick Tip

Predation is a $+/-$ interaction where one species benefits and the other is harmed.

39. Given below are two statements:

Statement I: An orchid grows as an epiphyte on a mango branch where the mango tree does not derive any apparent benefit from it.

Statement II: An orchid growing on a mango tree is an example of commensalism.

Choose the correct answer from the options given below:

- (1) Both Statement I and Statement II are true
- (2) Both Statement I and Statement II are false
- (3) Statement I is true, but Statement II is false
- (4) Statement I is false, but Statement II is true

Correct Answer: (1) Both Statement I and Statement II are true

Solution: Orchids benefit by growing on mango trees without harming them, which is an example of commensalism, where one species benefits, and the other is unaffected.

Quick Tip

In commensalism, one species benefits while the other is unaffected.

40. Match List-I with List-II:

List-I (Examples)	List-II (Interactions)
(A) Extinction of Abingdon tortoise after introduction of goats on Galapagos Islands	(I) Parasitism
(B) Infestations of marine fish by copepods	(II) Commensalism
(C) Cattle egret and grazing cattle	(III) Mutualism
(D) Fig tree and wasp	(IV) Competition

Choose the correct answer from the options given below:

- (1) (A) - (IV), (B) - (II), (C) - (I), (D) - (III)
- (2) (A) - (II), (B) - (III), (C) - (I), (D) - (IV)
- (3) (A) - (III), (B) - (II), (C) - (IV), (D) - (I)
- (4) (A) - (IV), (B) - (I), (C) - (II), (D) - (III)

Correct Answer: (4) (A) - (IV), (B) - (I), (C) - (II), (D) - (III)

Solution: The correct matches reflect various ecological interactions: competition, parasitism, commensalism, and mutualism.

Quick Tip

Memorize common examples of ecological interactions to identify them quickly.

41. Select the incorrect pair in response to abiotic factors:

- (1) We maintain a constant body temperature of 37°C – Conformer
- (2) Every winter Keoladeo National Park hosts the birds coming from Siberia – Migration

- (3) Under unfavorable conditions many zooplankton species in ponds enter the stage of suspended development – Diapause
- (4) If a predator is too efficient it overexploits its prey – Extinction

Correct Answer: (1) We maintain a constant body temperature of 37°C – Conformer

Solution: Humans maintain a constant internal temperature, making us regulators rather than conformers. Conformers are organisms whose body temperature varies with the environment.

Quick Tip

Regulators maintain stable internal conditions; conformers change with the environment.

42. Which one is the correct example of hermaphrodites?

- (1) Tapeworm and leech
- (2) Cockroach and frog
- (3) Cockroach and earthworm
- (4) Carp fish and pigeon

Correct Answer: (1) Tapeworm and leech

Solution: Hermaphroditic organisms, such as tapeworms and leeches, possess both male and female reproductive organs. Cockroaches and fish have separate sexes.

Quick Tip

Hermaphrodites contain both male and female reproductive organs.

43. In diploid organisms, which of the following undergoes meiosis?

- (1) Vegetative cell
- (2) Sporogenous tissue
- (3) Pollen grain
- (4) Synergids

Correct Answer: (2) Sporogenous tissue

Solution: In plants, meiosis occurs in sporogenous tissue to produce spores. Other cells like vegetative cells do not undergo meiosis.

Quick Tip

Meiosis typically occurs in tissue responsible for spore production.

44. Who proposed that the first form of life could have come from pre-existing non-living organic molecules?

- (1) Darwin
- (2) Oparin and Haldane
- (3) Lamarck
- (4) Thomas Malthus

Correct Answer: (2) Oparin and Haldane

Solution: Oparin and Haldane hypothesized that life originated from organic molecules through chemical evolution in a "primordial soup."

Quick Tip

Remember: Oparin and Haldane suggested the "primordial soup" theory for life's origins.

45. Given below are two statements:

Statement I: In a bioreactor, small volumes of cultures are developed where useful bio-products are produced.

Statement II: In downstream processing, products formulated with preservatives are ready for marketing without quality testing.

Choose the correct answer from the options given below:

- (1) Both Statement I and Statement II are true
- (2) Both Statement I and Statement II are false
- (3) Statement I is true, but Statement II is false
- (4) Statement I is false, but Statement II is true

Correct Answer: (3) Statement I is true, but Statement II is false

Solution: While bioreactors do produce useful bio-products in culture, downstream processing involves quality testing before products are marketed.

Quick Tip

Downstream processing includes product quality testing.

46. The method where an ovum is transferred from a donor into the fallopian tube of another female is:

- (1) IUI
- (2) ICSI
- (3) GIFT
- (4) ZIFT

Correct Answer: (3) GIFT

Solution: In Gamete Intra-Fallopian Transfer (GIFT), an ovum is transferred to the fallopian tube, facilitating fertilization in the body of the recipient female.

Quick Tip

GIFT involves transferring an ovum to the fallopian tube for fertilization.

47. When one of the parents has 'A' blood group and the other parent has 'O' blood group, then their child can have ____ blood group.

- (1) Only 'A'
- (2) Only 'O'
- (3) Both 'A' and 'O'
- (4) Either 'A' or 'O'

Correct Answer: (4) Either 'A' or 'O'

Solution: If one parent has blood group 'A' (genotype AO) and the other parent has blood group 'O' (genotype OO), their offspring could inherit either the 'A' allele from the 'A' parent or the 'O' allele from the 'O' parent, leading to possible blood groups of 'A' or 'O'.

Quick Tip

For blood groups: 'A' (AO) and 'O' (OO) parents can have children with blood types 'A' or 'O'.

48. The size of VNTR varies from:

- (1) 0.1 to 20 kb
- (2) 0.1 to 10 kb
- (3) 0.2 to 15 kb

(4) 0.2 to 10 kb

Correct Answer: (1) 0.1 to 20 kb

Solution: Variable Number Tandem Repeats (VNTRs) are short nucleotide sequences that vary greatly in length, typically from 0.1 to 20 kilobases.

Quick Tip

VNTR lengths generally range from 0.1 to 20 kb.

49. The common approach(es) for the treatment of cancer is/are:

- (A) Vaccination**
- (B) Surgery**
- (C) Physiotherapy**
- (D) Radiation therapy**
- (E) Immunotherapy**

Choose the correct answer from the options given below:

- (1) (A) only**
- (2) (B), (D) and (E) only**
- (3) (A), (C) and (D) only**
- (4) (A) and (C) only**

Correct Answer: (2) (B), (D) and (E) only

Solution: Cancer treatment commonly involves surgery, radiation therapy, and immunotherapy. Physiotherapy is not a primary cancer treatment.

Quick Tip

Cancer treatments typically include surgery, radiation, and immunotherapy.

50. Which of the following controls/control the growth of bollworms?

- (1) CryIAc and CryIIAb genes**
- (2) CryIAb gene**
- (3) RNAi**
- (4) dsRNA**

Correct Answer: (1) CryIAc and CryIIAb genes

Solution: The CryIAc and CryIIAb genes produce proteins toxic to bollworms, used in genetically modified crops like Bt cotton for pest resistance.

Quick Tip

Cry genes in Bt cotton target pests like bollworms.