Subject : BIOLOGY - Set D
Code : 304 E

Total Time Allowed : 45 minutes	Maximum Marks : 200	Total Questions : 50	Questions to be answered : 40

Q1: In a country, at any time, the population has the same number of young and mature ones. What type of growth does it reflect?
1. Expanding
2. Declining
3. Stable
4. S-shaped

Correct Answer: 3. Stable
Solution: A stable population shows equal proportions of young and mature individuals, which reflects balanced birth and death rates over time.

Quick Tip

Stable growth implies equilibrium in demographic structure.

Q2: Two closely related species can co-exist indefinitely and violate Gause's 'Competitive Exclusion Principle' by:
1. Eliminating the inferior species
2. Resource partitioning
3. Interacting with each other symbiotically
4. Changing the area of grazing

Correct Answer: 2. Resource partitioning
Solution: Resource partitioning allows closely related species to divide resources or use them in different ways, reducing competition and enabling coexistence.

Quick Tip

Resource partitioning minimizes competition for shared resources.

Q3: The process of mineralisation by microorganisms helps in the release of:
1. Inorganic nutrients from detritus and formation of humus
2. Organic nutrients from humus
3. Inorganic nutrients from humus
4. Organic and inorganic nutrients from detritus

Correct Answer: 1. Inorganic nutrients from detritus and formation of humus
Solution: Mineralisation involves the breakdown of detritus by microorganisms, releasing inorganic nutrients essential for plant growth and forming humus.

Quick Tip

Mineralisation: Detritus → Inorganic nutrients + Humus.

Q4: In which ecosystem is the biomass of primary consumers greater than producers?
1. Forests
2. Grassland
3. Desert
4. Sea

Correct Answer: 4. Sea
Solution: In aquatic ecosystems like seas, primary consumers such as zooplankton often have a greater biomass than phytoplankton due to the rapid turnover of phytoplankton.

Quick Tip

Aquatic ecosystems: High consumer biomass, rapid producer turnover.

Q5: Match List-I with List-II:

List-I (Relationships)	List-II (Features)
(A) Commensalism	(I) One species is benefitted at the expense of the other
(B) Mutualism	(II) One species is harmed, the other is unaffected
(C) Amensalism	(III) Both species benefit
(D) Parasitism	(IV) One species benefits, the other remains unaffected

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

Correct Answer: 2. (A) - (IV), (B) - (III), (C) - (II), (D) - (I)
Solution: - Commensalism: One species benefits, the other remains unaffected.
- Mutualism: Both species benefit.
- Amensalism: One species is harmed, the other unaffected.
- Parasitism: One species benefits at the expense of the other.

Quick Tip

Key relationships: - Commensalism → Benefit, no harm. - Mutualism → Mutual benefit. - Amensalism → Harm, no effect. - Parasitism → Benefit, harm.

Q6: Choose the correct statements with respect to decomposition from the following:
(A) Decomposition is an anaerobic process.

(B) Decomposition rate of detritus depends upon its chemical nature.
(C) Water-soluble organic nutrients go into the soil and get precipitated in the process of leaching.
(D) Humification follows mineralisation.

Options:
1. (B) and (D) only
2. (A) and (C) only
3. (B) and (C) only
4. (A) and (D) only

Correct Answer: 1. (B) and (D) only
Solution:
- (A) Incorrect: Decomposition is primarily an aerobic process.
- (B) Correct: Decomposition depends on the chemical nature of detritus (e.g., lignin content).
- (C) Incorrect: Water-soluble nutrients are leached into the soil but do not precipitate.
- (D) Correct: Humification occurs after mineralisation.

Quick Tip

Decomposition is aerobic. Humification follows mineralisation in organic breakdown.

Q7: Match List-I with List-II:

List-I (Concepts)	List-II (Explanation)
(A) Standing state	(I) Available biomass for heterotrophs
(B) Secondary productivity	(II) Rate of organic matter formation by consumers
(C) Standing crop	(III) Mass of living matter in a trophic level
(D) Net primary productivity	(IV) Amount of mineral nutrients in soil

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

Correct Answer: 3. (A) - (IV), (B) - (II), (C) - (III), (D) - (I)
Solution:
- (A) Standing state: Refers to the amount of nutrients in the soil.
- (B) Secondary productivity: Organic matter production rate by consumers.
- (C) Standing crop: Mass of living matter in a trophic level.
- (D) Net primary productivity: Biomass available for heterotroph consumption.

Quick Tip

Standing state → Nutrients. Standing crop → Living biomass. NPP → Biomass for heterotrophs.

Read the passage carefully and answer the next five questions:
India was amongst the first countries in the world to initiate action plans and programmes at a national level to attain total reproductive health as a social goal. These programmes called 'family planning' were initiated in 1951 and were periodically assessed over the past decades. Improved programmes covering wider reproduction-related areas are currently in operation. Creating awareness among the people about various reproduction-related aspects and providing facilities and support for building up a reproductively healthy society are the major tasks under these programmes.

Q8: Which of the following is not a Sexually Transmitted Disease (STD)?
1. Chlamydiasis
2. Filariasis
3. Genital herpes
4. Trichomoniasis

Correct Answer: 2. Filariasis
Solution: Filariasis is a mosquito-borne disease caused by parasitic worms, while the others listed are sexually transmitted diseases.

Quick Tip

Filariasis = Mosquito-borne, not sexually transmitted.

Q9: Which of the following statements is incorrect with respect to Medical Termination of Pregnancy (MTP)?
1. They are considered safe during the first trimester.
2. It is legalized in India from 1971.
3. MTPs can be performed even after 24 weeks, but with the opinion of 2 registered medical practitioners on specific grounds.
4. About 20% of the total number of conceived pregnancies undergo MTP in a year globally.

Correct Answer: 4. About 20% of the total number of conceived pregnancies undergo MTP in a year globally.
Solution: MTPs are generally safe during the first trimester and regulated in India under the Medical Termination of Pregnancy Act (1971). However, the global figure of 20

Quick Tip

MTP safety: Regulated globally but not as widespread as claimed in option 4.

Q10: Match List-I with List-II:

List-I (ART Techniques)	List-II (Processes)
(A) ZIFT	(I) Formation of embryo in vitro by injecting sperm into ovum
(B) ICSI	(II) Transferring embryos with ¿8 blastomeres into uterus
(C) IUI	(III) Transfer of fertilized egg (up to 8 blastomeres) into fallopian tube
(D) IUT	(IV) Artificial transfer of semen into uterus

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

Correct Answer: 2. (A) - (III), (B) - (I), (C) - (IV), (D) - (II)
Solution:
- ZIFT: Transfer of fertilized eggs (up to 8 blastomeres) into the fallopian tube.
- ICSI: Formation of embryos by injecting sperm into the ovum in vitro.
- IUI: Artificial insemination of semen into the uterus.
- IUT: Transfer of embryos with more than 8 blastomeres into the uterus.

Quick Tip

ZIFT → Early embryos into fallopian tube, ICSI → Sperm injection, IUI → Semen transfer, IUT → Advanced embryos into uterus.

Q11: Which of the following methods of contraception is not meant for females?
1. IUDs
2. Lactational amenorrhea
3. Vasectomy
4. Condoms

Correct Answer: 3. Vasectomy
Solution: Vasectomy is a permanent contraceptive method performed on males. It involves cutting or sealing the vas deferens to prevent the release of sperm.

Quick Tip

Vasectomy = Male-specific contraception. IUDs, lactational amenorrhea, and condoms are primarily female contraceptives.

Q12: *Saheli*—an oral contraceptive pill, also known as the "Once a week" pill, was

developed by:
1. AIIMS
2. NBRI
3. CDRI
4. NBPGR

Correct Answer: 3. CDRI
Solution: *Saheli*, developed by the Central Drug Research Institute (CDRI), Lucknow, is a non-steroidal contraceptive pill taken once a week. It is recognized as a safe and effective method of contraception.

Quick Tip

Saheli is India's weekly, non-steroidal oral contraceptive pill developed by CDRI.

Read the passage carefully and give the answers to the next five questions:

Does the number of species in a community really matter to the functioning of the ecosystem? This is a question for which ecologists have not been able to give a definitive answer. For many decades, ecologists believed that communities with more species, generally, tend to be more stable than those with less species. According to the International Union for Conservation of Nature and Natural Resources (IUCN) (2004), the total number of plant and animal species described so far is more than 1.5 million.

Q13: Which of the following is not a characteristic of a stable biological community?
1. It must be resistant to invasions by alien species.
2. It should not show too much variation in productivity from year to year.
3. All the species are equally important in a stable community, and absence of any one leads to its instability.
4. It is resilient to occasional disturbances, whether natural or man-made.

Correct Answer: 3. All the species are equally important in a stable community, and absence of any one leads to its instability.
Solution: In a stable biological community, not all species are equally important. Keystone species have a disproportionate impact on community stability, while other species play minor roles.

Quick Tip

Keystone species are critical for ecosystem stability. Not all species have equal importance.

Q14: In the 'rivet popper hypothesis,' the 'rivet' signifies:
1. Key species
2. Endemic species

3. Community
4. Species

Correct Answer: 4. Species
Solution: The rivet popper hypothesis compares species in an ecosystem to rivets in an airplane. Each species contributes to ecosystem stability, and losing too many species may lead to ecosystem collapse.

Quick Tip

Think of rivets as species—removing too many compromises the stability of the ecosystem.

Q15: The scientist who proved that species richness directly correlates with the stability of a community was:
1. Paul Ehrlich
2. David Tilman
3. Robert May
4. Edward Wilson

Correct Answer: 2. David Tilman
Solution: David Tilman's experiments demonstrated that ecosystems with greater species richness are more stable and resilient to environmental disturbances. His findings highlight the role of biodiversity in maintaining ecosystem functionality.

Quick Tip

David Tilman's studies emphasized species richness as a key factor in ecosystem stability.

Q16: Among vertebrates, which of the following is the most species-rich group?
1. Reptiles
2. Fishes
3. Insects
4. Mammals

Correct Answer: 2. Fishes
Solution: Fishes are the most species-rich group among vertebrates, with over 33,000 species identified. They inhabit diverse aquatic environments worldwide, contributing significantly to global biodiversity.

Quick Tip

Fishes dominate vertebrate biodiversity, while insects lead among invertebrates.

Q17: The following are the various hypotheses proposed in explaining the greatest biological diversity in the tropics, except:
1. Temperate regions are subjected to glaciations, but tropical latitudes have remained relatively undisturbed.
2. Tropical environments have more humidity/moisture which helps the diversity to flourish.
3. Tropical environments are less seasonal and more constant.
4. There is more solar energy available in the tropics which contributes to higher productivity and hence, biodiversity.

Correct Answer: 2. Tropical environments have more humidity/moisture which helps the diversity to flourish.
Solution: While humidity and moisture may support tropical diversity, other factors such as stability, constant climate, and solar energy are more significant contributors to high biodiversity.

Quick Tip

Key factors in tropical biodiversity: stability, abundant solar energy, and lack of glaciation.

Q18: Cells present in the mature pollen grains are _____.
1. Central cell and generative cell
2. Antipodal cell and vegetative cell
3. Vegetative cell and generative cell
4. Filiform cell and micropylar cell

Correct Answer: 3. Vegetative cell and generative cell
Solution: Mature pollen grains consist of two cells: a large vegetative cell and a smaller generative cell, which divides to form sperm cells during fertilization.

Quick Tip

Remember: Mature pollen grains have a vegetative cell and a generative cell for reproduction.

Q19: Match List-I with List-II:

List-I (Structures)	**List-II (Functions)**
(A) Filiform apparatus	(I) Made up of sporopollenin
(B) Tapetum	(II) Attachment of ovule to the placenta
(C) Exine	(III) Guides pollen tube into the synergid
(D) Funicle	(IV) Nourishes the pollen grain

Options:
1. (A) - (IV), (B) - (I), (C) - (II), (D) - (III)

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

Correct Answer: 2. (A) - (III), (B) - (IV), (C) - (I), (D) - (II)
Solution:
- Filiform apparatus: Guides pollen tube to the synergid.
- Tapetum: Provides nourishment to the developing pollen grains.
- Exine: Made of sporopollenin, providing durability.
- Funicle: Connects the ovule to the placenta.

Quick Tip

Filiform guides pollen, tapetum nourishes, exine protects, and funicle connects.

Q20: Primary Endosperm Nucleus is the product of:
1. Double fusion
2. Triple fusion
3. Parthenogenesis
4. Apomixis

Correct Answer: 2. Triple fusion
Solution: The primary endosperm nucleus is formed by the fusion of one sperm nucleus with the two polar nuclei in the embryo sac, a process called triple fusion.

Quick Tip

Triple fusion = Sperm nucleus + Two polar nuclei → Primary Endosperm Nucleus.

Q21: In humans, mammary gland is divided into _____ lobes.
1. 10 – 12
2. 25 – 30
3. 30 – 35
4. 15 – 20

Correct Answer: 4. 15 – 20
Solution: The human mammary gland is divided into 15–20 lobes, each containing milk-producing alveoli.

Quick Tip

Human mammary glands have 15–20 lobes for milk production.

Q22: Sex in human embryo is determined by:
1. 'X' chromosome of egg

2. 'X' or 'Y' chromosome of sperm
3. Only 'Y' chromosome of sperm
4. Health of mother

Correct Answer: 2. 'X' or 'Y' chromosome of sperm

Solution: Sex in human embryos is determined by the type of sperm that fertilizes the egg. Sperm carrying an X chromosome results in a female, while sperm carrying a Y chromosome results in a male.

Quick Tip

Sperm determines sex: X → Female, Y → Male.

Q23: Arrange the following stages of oogenesis in order of their occurrence:
(A) Ovum
(B) Oogonia
(C) Primary oocyte
(D) Secondary oocyte

Options:
1. (C), (B), (D), (A)
2. (B), (C), (D), (A)
3. (D), (C), (A), (B)
4. (A), (D), (C), (B)

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

Solution: The correct sequence of oogenesis is:
1. Oogonia (immature germ cells).
2. Primary oocyte (formed during fetal development).
3. Secondary oocyte (formed during meiosis I).
4. Ovum (formed after meiosis II and fertilization).

Quick Tip

Oogonia → Primary oocyte → Secondary oocyte → Ovum.

Q24: Which of the following pair of contrasting traits was **not** studied by Mendel?
1. Pink and white flowers
2. Inflated and constricted pods
3. Axial and terminal flowers
4. Green and yellow pods

Correct Answer: 1. Pink and white flowers

Solution: Mendel studied traits like seed shape, seed color, flower position, and pod shape, but he did not study flower color as pink and white (he studied purple and white).

Quick Tip

Mendel studied purple and white flowers, not pink and white.

Q25: Failure of chromatids to segregate during cell division cycle results in:
1. Polyploidy
2. Euploidy
3. Aneuploidy
4. Autopolyploidy

Correct Answer: 3. Aneuploidy
Solution: Aneuploidy occurs when there is an addition or loss of chromosomes due to improper segregation of chromatids during cell division. For example, Down syndrome results from an extra chromosome 21.

Quick Tip

Aneuploidy: Improper segregation → Abnormal chromosome number.

Q26: Select the correctly matched pair about sickle cell anaemia:
Genotype : Phenotype
(A) Hb^AHb^A : Diseased phenotype
(B) Hb^AHb^S : Diseased phenotype
(C) Hb^SHb^S : Diseased phenotype
(D) Hb^SHb^A : Carrier of disease

Options:
1. (C) and (D) only
2. (A) and (C) only
3. (B), (C) and (D) only
4. (A), (B), and (C) only

Correct Answer: 1. (C) and (D) only
Solution:
- Hb^AHb^A: Normal phenotype (not diseased).
- Hb^AHb^S: Carrier of sickle cell anaemia.
- Hb^SHb^S: Diseased phenotype (sickle cell anaemia).
- Hb^SHb^A: Carrier of disease.

Quick Tip

Sickle cell anaemia: Hb^SHb^S = Diseased, Hb^AHb^S = Carrier.

Q27: Match List-I with List-II:

List-I (Scientists)	List-II (Discovery)
(A) Sutton and Boveri	(I) X-Body
(B) Sturtevant	(II) Chromosomal Theory of Inheritance
(C) Henking	(III) Transformation in bacteria
(D) Griffith	(IV) Genetic maps

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

Correct Answer: 1. (A) - (II), (B) - (IV), (C) - (I), (D) - (III)
Solution:
- Sutton and Boveri: Proposed the Chromosomal Theory of Inheritance.
- Sturtevant: Developed genetic maps.
- Henking: Discovered the X-Body, now known as the X chromosome.
- Griffith: Demonstrated bacterial transformation in his experiments.

Quick Tip

Remember:
- Sutton and Boveri → Chromosomes.
- Sturtevant → Genetic maps.
- Henking → X-Body.
- Griffith → Transformation.

Q28: Which of the following statements are **incorrect** with respect to nucleotides?
(A) Purines and pyrimidines are nitrogenous bases.
(B) Nucleotides are non-enzymatic molecules.
(C) Phosphate group is linked to –OH of 5' C of a nucleoside through phosphoester linkage.
(D) In RNA, every nucleotide residue has an additional –OH group present at 2' position in the ribose.
(E) Thymine is an example of Pyrimidine.

Options:
1. (A), (B), and (E) only
2. (D) and (E) only
3. (B) and (D) only
4. (B) and (E) only

Correct Answer: 2. (D) and (E) only
Solution:
- (A) Correct: Purines (adenine, guanine) and pyrimidines (cytosine, thymine, uracil) are nitrogenous bases.

- (B) Correct: Nucleotides are not enzymes.
- (C) Correct: Phosphate attaches to 5' carbon of nucleoside.
- (D) Incorrect: In RNA, the ribose sugar has a 2' –OH group, but not every nucleotide residue has this group.
- (E) Incorrect: Thymine is a pyrimidine found in DNA, but not in RNA.

Quick Tip

Thymine is in DNA, while RNA has uracil. Ribose in RNA has an additional –OH group.

Q29: Arrange the given steps of DNA fingerprinting in the sequence from initiation to end:
(A) Digestion of DNA by restriction endonuclease
(B) Isolation of DNA
(C) Hybridisation using labelled VNTR probe
(D) Transferring (blotting) of separated DNA fragments to synthetic membrane

Options:
1. (A), (B), (C), (D)
2. (A), (D), (B), (C)
3. (B), (A), (D), (C)
4. (C), (D), (A), (B)

Correct Answer: 3. (B), (A), (D), (C)
Solution: The correct sequence for DNA fingerprinting is:
1. Isolation of DNA (B): DNA is extracted from the sample.
2. Digestion by restriction endonucleases (A): DNA is cut into fragments.
3. Blotting to synthetic membrane (D): DNA fragments are transferred to a nylon or nitrocellulose membrane.
4. Hybridisation with VNTR probe (C): Probes hybridize with complementary DNA sequences.

Quick Tip

DNA fingerprinting steps: Isolation → Digestion → Blotting → Hybridisation.

Q30: Nucleosome is associated with _____ molecules of histones.
1. Four
2. Nine
3. Two
4. Eight

Correct Answer: 4. Eight
Solution: A nucleosome consists of eight histone proteins, forming an octamer (two each of H2A, H2B, H3, and H4), around which DNA is wrapped.

Quick Tip

Nucleosome = DNA wrapped around a histone octamer (8 molecules).

Q31: Select the observations drawn from the human genome project which are correct:
(A) The human genome contains 3164.7 million bp.
(B) The average gene consists of 3000 bases.
(C) Total number of genes is estimated at 30,000.
(D) The functions are unknown for over 50% of discovered genes.
(E) Less than 2% of the genome codes for proteins.

Options:
1. (A), (B), (C) and (D) only
2. (A), (C), (D) and (E) only
3. (A), (C) and (E) only
4. (A), (B), (C), (D) and (E)

Correct Answer: 4. (A), (B), (C), (D) and (E)
Solution: All listed statements are true observations from the Human Genome Project, which revealed the detailed composition and structure of the human genome.

Quick Tip

Key HGP facts: 3164.7 million bp, 30,000 genes, ¡2% coding DNA, unknown functions for 50% of genes.

Q32: Analogous structures are a result of:
1. Convergent evolution
2. Divergent evolution
3. Parallel evolution
4. Retrogressive evolution

Correct Answer: 1. Convergent evolution
Solution: Analogous structures arise from convergent evolution, where different organisms independently evolve similar traits to adapt to similar environments.

Quick Tip

Analogous = Similar function, different origin → Convergent evolution.

Q33: Which of the following does **not** affect the Hardy-Weinberg equilibrium?
1. Natural selection
2. Genetic drift
3. Gene pool
4. Gene migration

Correct Answer: 3. Gene pool
Solution: The Hardy-Weinberg equilibrium is disturbed by factors like natural selection, genetic drift, gene flow, and mutation. The gene pool itself does not directly affect the equilibrium unless it undergoes change.

Quick Tip

Hardy-Weinberg equilibrium factors: Selection, drift, migration, mutation—not the static gene pool.

Q34: Which of the following primates was more like an ape?
1. *Homo erectus*
2. *Dryopithecus*
3. *Australopithecines*
4. *Ramapithecus*

Correct Answer: 2. *Dryopithecus*
Solution: *Dryopithecus* is considered an early ape-like primate. It was quadrupedal and arboreal, more similar to modern apes than humans.

Quick Tip

Dryopithecus = Ape-like; *Homo erectus* and *Australopithecines* = Human ancestors.

Q35: Match List-I with List-II:

List-I (Placental mammals)	List-II (Counterpart Marsupials)
(A) Anteater	(I) Spotted cuscus
(B) Bobcat	(II) Numbat
(C) Lemur	(III) Flying Phalanger
(D) Flying squirrel	(IV) Tasmanian tiger cat

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

Correct Answer: 1. (A) - (II), (B) - (IV), (C) - (I), (D) - (III)
Solution:
- Anteater matches with the marsupial Numbat.
- Bobcat corresponds to Tasmanian tiger cat.
- Lemur pairs with Spotted cuscus.
- Flying squirrel is matched with Flying Phalanger.

Quick Tip

Placental mammals and marsupials often exhibit convergent evolution, leading to ecological equivalents.

Q36: Identify the incorrect statement(s):
(A) Intestinal perforation and death may occur in severe cases of typhoid infection.
(B) Common cold is caused by Rhinoviruses.
(C) Lips and fingernails may turn grey to bluish color in severe cases of pneumonia.
(D) Pneumonia is caused by Salmonella.
(E) Typhoid fever could be confirmed by Widal test.

Options:
1. (A), (C), and (D) only
2. (B) and (E) only
3. (D) only
4. (A) and (D) only

Correct Answer: 3. (D) only
Solution:
- (A) Correct: Severe typhoid can cause intestinal perforation.
- (B) Correct: Common cold is caused by Rhinoviruses.
- (C) Correct: Bluish lips and fingernails indicate hypoxia in severe pneumonia.
- (D) Incorrect: Pneumonia is caused by Streptococcus pneumoniae, not Salmonella.
- (E) Correct: Widal test diagnoses typhoid fever.

Quick Tip

Pneumonia = Streptococcus pneumoniae; Typhoid = Salmonella.

Q37: Match List-I with List-II:

List-I (Types of barriers)	List-II (Examples)
(A) Cytokine barriers	(I) Mucus coating
(B) Physical barriers	(II) Tears from eyes
(C) Cellular barriers	(III) Phagocytosis
(D) Physiological barriers	(IV) Interferons

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

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

- (A) Cytokine barriers: Interferons act as antiviral proteins.
- (B) Physical barriers: Tears protect from infections.
- (C) Cellular barriers: Phagocytosis by macrophages.
- (D) Physiological barriers: Mucus traps pathogens.

Quick Tip

Barriers are categorized as physical (tears), physiological (mucus), cellular (phagocytosis), and cytokine (interferons).

Q38: Smack is chemically:
1. Diacetyl morphine
2. Cocaine
3. Benzodiazepine
4. Amphetamine

Correct Answer: 1. Diacetyl morphine
Solution: Smack, commonly known as heroin, is chemically diacetyl morphine, a semi-synthetic opioid.

Quick Tip

Diacetyl morphine (heroin) is categorized as an opioid.

Q39: Antibodies are secreted by:
1. T-Cells
2. B-Cells
3. α-Cells
4. β-Cells

Correct Answer: 2. B-Cells
Solution: B-cells are specialized white blood cells that produce and secrete antibodies as part of the adaptive immune response.

Quick Tip

B-cells = Antibody production. T-cells = Cell-mediated immunity.

Q40: In sewage treatment, flocs are:
1. The solids that settle during sedimentation.
2. The supernatant formed above primary sludge.
3. The masses of bacteria associated with fungal filaments.
4. The bacteria which grow anaerobically and are also called anaerobic sludge digesters.

Correct Answer: 3. The masses of bacteria associated with fungal filaments.

Solution: Flocs are aggregates of bacteria and fungi that aid in decomposing organic matter during the secondary treatment of sewage.

Quick Tip

Flocs play a crucial role in secondary sewage treatment by aiding organic matter decomposition.

Q41: Match List-I with List-II:

List-I (Products)	List-II (Organisms)
(A) Statin	(I) Streptococcus
(B) Clot buster	(II) Trichoderma
(C) Swiss cheese	(III) Monascus
(D) Cyclosporin-A	(IV) Propionibacterium

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

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

Product	Organism/Explanation
Statin	Monascus - Lowers cholesterol.
Clot buster	Streptococcus - Produces streptokinase.
Swiss cheese	Propionibacterium - Used in fermentation.
Cyclosporin-A	Trichoderma - Acts as an immunosuppressant.

Quick Tip

Statin → Monascus, Clot buster → Streptococcus, Swiss cheese → Propionibacterium, Cyclosporin-A → Trichoderma.

Q42: The beetle used as a biocontrol agent for aphids and mosquitoes is:
1. *Trichoderma*
2. Dragonflies
3. Ladybird
4. Silverfish

Correct Answer: 3. Ladybird
Solution: Ladybird beetles are natural predators of aphids and other pests, making them effective biocontrol agents.

Quick Tip

Ladybird beetles = Natural pest control.

Q43: Downstream processing method involves:
1. Identification
2. Amplification
3. Fermentation
4. Purification

Correct Answer: 4. Purification
Solution: Downstream processing refers to the recovery and purification of biosynthetic products such as proteins, which ensures their usability.

Quick Tip

Downstream processing includes purification as a crucial step for usable products.

Q44: Which of the following is not the correctly matched pair of organism and its respective cell wall degrading enzyme?
1. Fungi – Chitinase
2. Algae – Methylase
3. Plant cells – Cellulase
4. Bacteria – Lysozyme

Correct Answer: 2. Algae – Methylase
Solution: Methylase modifies nucleic acids rather than degrading algal cell walls. Other pairs (Chitinase, Cellulase, Lysozyme) are correct matches.

Quick Tip

Methylase modifies nucleic acids, not cell walls. Cellulase, chitinase, and lysozyme are true matches.

Q45: Arrange the following steps involved in the transformation of bacteria in sequence from initiation to end:
(A) Incubation of rDNA with bacterial cells on ice
(B) Treatment with divalent cations
(C) Heat shock treatment
(D) Selection on antibiotic-containing agar plate
(E) Placed them again on ice

Options:
1. (A), (B), (D), (C), (E)
2. (B), (A), (C), (E), (D)

3. (B), (C), (D), (A), (E)
4. (A), (C), (B), (D), (E)

Correct Answer: 2. (B), (A), (C), (E), (D)
Solution: Steps in bacterial transformation:
1. Treatment with divalent cations (e.g., Ca^{2+}) increases cell permeability.
2. Incubation with rDNA on ice aids DNA uptake.
3. Heat shock creates conditions for DNA entry.
4. Ice stabilization follows.
5. Antibiotic selection identifies transformed cells.

Quick Tip

Transformation sequence: Divalent cations → Incubation → Heat shock → Ice → Selection.

Q46: Which of the following statements are incorrect?
(A) Fragments of DNA can be separated by ELISA.
(B) Transformation introduces DNA into a host bacterium.
(C) Recombinant DNA technology does not involve isolation of a desired DNA fragment.
(D) DNA ligases are used for stitching DNA fragments into a vector.

Options:
1. (A) and (C) only
2. (A) and (B) only
3. (B) and (C) only
4. (A), (C), and (D) only

Correct Answer: 1. (A) and (C) only
Solution:
- (A) Incorrect: ELISA is used to detect antigens or antibodies, not DNA fragments.
- (C) Incorrect: Isolation of the desired DNA fragment is an essential step in recombinant DNA technology.
- (B) and (D) are correct: Transformation introduces DNA, and ligases join DNA fragments.

Quick Tip

ELISA detects proteins, not DNA fragments. Recombinant DNA technology includes DNA isolation.

Q47: Which of the following statements are true?
(A) Milk from 'Rosie' is nutritionally more balanced for human babies than natural human milk.
(B) Biopiracy refers to the use of bioresources without proper authorization.
(C) GEAC is the decisive body for GMO safety and research.

(D) Transgenic animals help us study the contribution of genes in the development of diseases.

Options:
1. (A) and (C) only
2. (C) and (D) only
3. (B) and (C) only
4. (A), (B), and (C) only

Correct Answer: 2. (C) and (D) only

Solution:
- (A) False: While 'Rosie' produces milk enriched with human proteins, it is not more balanced than human milk.
- (B) False: Biopiracy involves unauthorized use of bioresources but is not specific to MNCs.
- (C) True: GEAC regulates GMO safety.
- (D) True: Transgenic animals help in genetic research for disease understanding.

Quick Tip

GEAC ensures GMO safety. Transgenic animals aid in studying genetic diseases.

Q48: Match List-I with List-II:

List-I (Transgene)	List-II (Used for/Products)
(A) α-1-antitrypsin	(I) *Meloidogyne incognita*
(B) *cryIAc*	(II) Corn borer
(C) Antisense RNA	(III) Treat emphysema
(D) *cryIAb*	(IV) Cotton bollworms

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

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

Transgene	Explanation
α-1-antitrypsin	Treats emphysema caused by genetic disorders.
cryIAc	Effective against the corn borer pest.
Antisense RNA	Used to silence genes in nematode pests (*Meloidogyne incognita*).
cryIAb	Targets cotton bollworms.

Quick Tip

Key transgene associations: α-1-antitrypsin $\rightarrow$ Emphysema, *cryIAc* $\rightarrow$ Corn borer, Antisense RNA $\rightarrow$ Nematodes, *cryIAb* $\rightarrow$ Cotton bollworms.

Q49: Expand "GEAC":
1. Genetic and Environmental Advisory Committee
2. Gene Establishment Approval Committee
3. Genetic Engineering Advisory Committee
4. Genetic Engineering Approval Committee

Correct Answer: 4. Genetic Engineering Approval Committee
Solution: The Genetic Engineering Approval Committee (GEAC) is responsible for the safety and regulation of genetically modified organisms (GMOs) and related research in India.

Quick Tip

GEAC oversees GMO safety and research in India.

Q50: When an insect feeds on the *Bt* plant, the insect dies due to the conversion of inactive protein to active protein in:
1. Alkaline pH of the gut.
2. Acidic pH of the gut.
3. Acidic pH of saliva.
4. Alkaline pH of saliva.

Correct Answer: 1. Alkaline pH of the gut
Solution: *Bt* toxin, produced by *Bacillus thuringiensis*, is an inactive protoxin. In an insect's gut, the alkaline pH activates the toxin, which binds to gut cells, creating pores that kill the insect.

Quick Tip

Bt toxin $\rightarrow$ Alkaline gut $\rightarrow$ Toxin activation $\rightarrow$ Insect death.
