Subject : BIOLOGY - Set C
Code : 304 E

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

Q1: 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, which provides nourishment, and a smaller generative cell, which divides to form sperm cells during fertilization.

Quick Tip

Mature pollen grains contain a vegetative cell for nourishment and a generative cell for reproduction.

Q2: 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.

Q3: 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 forms when one sperm nucleus fuses 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.

Q4: 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

Mammary glands have 15–20 lobes for milk production.

Q5: 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: The sex of the embryo depends on the sperm's chromosome:
- Sperm with an X chromosome → Female (XX).
- Sperm with a Y chromosome → Male (XY).

Quick Tip

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

Q6: 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:
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.

Q7: 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. He did not study flower colors as pink and white but rather purple and white.

Quick Tip

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

Q8: Failure of chromatids to segregate during cell division results in:
1. Polyploidy
2. Euploidy
3. Aneuploidy
4. Autopolyploidy

Correct Answer: 3. Aneuploidy
Solution: Aneuploidy occurs due to improper segregation of chromatids during cell division, leading to an abnormal chromosome number. Example: Down syndrome results from an extra chromosome 21.

Quick Tip

Aneuploidy: Improper segregation → Abnormal chromosome number.

Q9: Select the correctly matched pair about sickle cell anemia:
Genotype: Phenotype (A) HbAHbA: Diseased phenotype
(B) HbAHbS: Diseased phenotype
(C) HbSHbS: Diseased phenotype
(D) HbSHbA: 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:
- HbAHbA: Normal phenotype (not diseased).
- HbAHbS: Carrier of sickle cell anemia.
- HbSHbS: Diseased phenotype (sickle cell anemia).
- HbSHbA: Carrier of disease.

Quick Tip

Sickle cell anemia: HbSHbS = Diseased, HbAHbS = Carrier.

Q10: 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

Correct Answer: (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 (X chromosome).
- Griffith: Demonstrated bacterial transformation.

Quick Tip

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

Q11: 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.

Correct Answer: (D) and (E) only
Solution:
- (A) Correct: Purines and pyrimidines are nitrogenous bases.
- (B) Correct: Nucleotides are non-enzymatic molecules.
- (C) Correct: Phosphate group links to 5 carbon of nucleoside.
- (D) Incorrect: In RNA, ribose has a 2 –OH group, but not every residue has it.
- (E) Incorrect: Thymine is found in DNA, not RNA.

Quick Tip

Thymine is in DNA, while uracil is in RNA. Ribose in RNA has a 2 –OH group.

Q12: Arrange the steps of DNA fingerprinting in sequence:
(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

Correct Answer: (B), (A), (D), (C)
Solution:
1. Isolation of DNA (B): Extracting DNA from cells.
2. Digestion by restriction enzymes (A): Cutting DNA into fragments.
3. Blotting to membrane (D): Transferring DNA fragments.
4. Hybridisation (C): Probing complementary sequences.

Quick Tip

Sequence: Isolation → Digestion → Blotting → Hybridisation.

Q13: Nucleosome is associated with ____ molecules of histones.
1. Four

2. Nine
3. Two
4. Eight

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

Quick Tip

A nucleosome contains 8 histones, forming an octamer.

Q14: Select the correct observations from the Human Genome Project:
(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.

Correct Answer: (A), (B), (C), (D), and (E)
Solution: All observations listed are accurate conclusions drawn from the Human Genome Project.

Quick Tip

HGP: 3164.7 million bp, 30,000 genes, ¡2% coding DNA.

Q15: Analogous structures are a result of:
1. Convergent evolution
2. Divergent evolution
3. Parallel evolution
4. Retrogressive evolution

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

Quick Tip

Analogous = Similar function, different origin → Convergent evolution.

Q16: 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: Gene pool
Solution: The Hardy-Weinberg equilibrium is influenced by factors like selection, drift, migration, and mutation. The static gene pool itself does not disturb the equilibrium.

Quick Tip

Hardy-Weinberg is affected by selection, drift, migration, and mutation—not the static gene pool.

Q17: Which of the following primates was more like an ape?
1. *Homo erectus*
2. *Dryopithecus*
3. *Australopithecines*
4. *Ramapithecus*

Correct Answer: *Dryopithecus*
Solution: *Dryopithecus* was quadrupedal and arboreal, resembling modern apes more than humans.

Quick Tip

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

Q18: 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.

Q19: 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 colour 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 lead to intestinal perforation. - (B) Correct: Rhinoviruses cause the common cold. - (C) Correct: Bluish lips and fingernails indicate severe hypoxia in pneumonia. - (D) Incorrect: Pneumonia is caused by Streptococcus pneumoniae, not Salmonella. - (E) Correct: Widal test is used for diagnosing typhoid.

Quick Tip

Pneumonia is caused by Streptococcus pneumoniae; typhoid is caused by Salmonella.

Q20: 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:
- Cytokine barriers: Interferons (antiviral proteins).

- Physical barriers: Tears protect from infections.
- Cellular barriers: Phagocytosis by macrophages.
- Physiological barriers: Mucus traps pathogens.

Quick Tip

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

Q21: 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.

Q22: 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.

Q23: 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: In sewage treatment, flocs are aggregates of bacteria and fungi that aid in the decomposition of organic matter during secondary treatment.

Quick Tip

Flocs play a crucial role in secondary treatment of sewage.

Q24: 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

Key associations: - Statin → Monascus (cholesterol control). - Clot buster → Streptococcus (streptokinase). - Swiss cheese → Propionibacterium (fermentation). - Cyclosporin-A → Trichoderma (immunosuppressant).

Q25: The beetle used as a biocontrol agent for aphids and mosquitoes is:
1. *Trichoderma*
2. Dragonflies
3. Ladybird
4. Silver fish

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

Quick Tip

Remember: Ladybird beetles = Pest management heroes.

Q26: Downstream processing method involves:
1. Identification
2. Amplification
3. Fermentation
4. Purification

Correct Answer: 4. Purification
Solution: Downstream processing refers to the steps in biotechnological processes that involve the recovery and purification of products such as proteins or other biosynthetic compounds.

Quick Tip

Downstream processing always ends with purification to ensure a usable product.

Q27: 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 does not degrade algal cell walls. Algal cell walls are typically degraded by cellulase or other specific enzymes. Other pairs are correctly matched:
- Fungi: Chitinase breaks down chitin.
- Plant cells: Cellulase degrades cellulose.
- Bacteria: Lysozyme hydrolyzes peptidoglycan.

Quick Tip

Methylase modifies nucleic acids, not cell walls. - Fungi → Chitinase. - Plants → Cellulase. - Bacteria → Lysozyme.

Q28: Arrange the following steps involved in the transformation of bacteria in a sequence from initiation to end:
(A) Incubation of rDNA with bacterial cell 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: The transformation process in bacteria follows this sequence:
1. Treatment with divalent cations (e.g., Ca^{2+}) to make bacterial membranes permeable.
2. Incubation with rDNA on ice to allow DNA uptake.
3. Heat shock treatment facilitates DNA entry into cells.
4. Cells are placed on ice again for stabilization.
5. Selection on antibiotic plates identifies successfully transformed cells.

Quick Tip

Key sequence for bacterial transformation: Divalent cations → Incubation → Heat shock → Ice → Selection.

Q29: Which of the following statements are incorrect?
(A) Fragments of DNA can be separated by ELISA.
(B) Transformation is a procedure through which a piece of DNA is introduced in 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) is incorrect: ELISA detects antigens or antibodies, not DNA fragments.
- (C) is incorrect: Recombinant DNA technology includes isolating the desired DNA fragment as an essential step. - (B) and (D) are correct: Transformation introduces DNA into a host, and ligases stitch DNA into vectors.

Quick Tip

ELISA = Protein/antibody detection. Recombinant DNA technology includes DNA isolation.

Q30: Which of the following statements are true?
(A) Milk obtained from 'Rosie' is nutritionally more balanced for human babies than natural human milk.

(B) Biopiracy refers to the use of bioresources without proper authorization from MNCs.
(C) GEAC is the decisive body for safety and validity of GMOs and GM research respectively.
(D) Transgenic animals help us to understand the contribution of genes in the development of disease.

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) is false: While 'Rosie' produces milk enriched with human proteins, it is not nutritionally more balanced than human milk. - (B) is false: Biopiracy involves unauthorized use of bioresources, not specifically linked to MNCs. - (C) is true: GEAC (Genetic Engineering Appraisal Committee) regulates GMO safety. - (D) is true: Transgenic animals help in understanding gene contributions to diseases.

Quick Tip

GEAC ensures GMO safety. Transgenic animals = Disease research tools.

Q31: 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
(A) α-1-antitrypsin	Treats emphysema caused by genetic disorders.
(B) *cryIAc*	Effective against the corn borer pest.
(C) Antisense RNA	Used to silence genes in nematode pests (*Meloidogyne incognita*).
(D) *cryIAb*	Targets cotton bollworms.

Quick Tip

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

Q32: 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: GEAC is responsible for the regulation and approval of genetically modified organisms (GMOs) and related research in India.

Quick Tip

GEAC ensures GMO safety and research approval in India.

Q33: 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: The *Bt* toxin, produced by *Bacillus thuringiensis*, is an inactive protoxin. In an insect's gut, the alkaline pH activates the toxin, which binds to the gut cells, creating pores and ultimately killing the insect.

Quick Tip

Remember: *Bt* toxin $\rightarrow$ Alkaline gut $\rightarrow$ Activation $\rightarrow$ Insect death.

Q34: Match List-I with List-II:

List-I (Interspecies Relationships)	**List-II (Features)**
(A) Commensalism	(I) One species is benefitted at the expense of the other
(B) Mutualism	(II) One species is harmed and 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 remains unaffected.
- Parasitism: One species benefits at the expense of the other.

Quick Tip

Commensalism → Benefit, no harm. Mutualism → Mutual benefit. Amensalism → Harm, no effect. Parasitism → Benefit, harm.

Q35: 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 is characterized by equal proportions of young and mature individuals, indicating balanced birth and death rates, resulting in a constant population size.

Quick Tip

Stable population: Equal young and mature proportions = Balanced growth.

Q36: 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 two similar species to utilize different aspects of the environment or the same resources in different ways, reducing direct competition and enabling coexistence.

Quick Tip

Resource partitioning reduces competition and promotes coexistence.

Q37: 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 occurs when microorganisms break down organic matter in detritus, releasing inorganic nutrients essential for plant growth and forming humus that enhances soil fertility.

Quick Tip

Mineralisation: Detritus → Inorganic nutrients + Humus formation.

Q38: 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, such as seas, the biomass of primary consumers (e.g., zooplankton) often exceeds that of producers (e.g., phytoplankton) because of the rapid turnover rate of phytoplankton, which reproduce quickly.

Quick Tip

Aquatic ecosystems: Phytoplankton turnover enables higher consumer biomass.

Q39: 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) is incorrect: Decomposition is primarily an aerobic process.
- (B) is correct: Decomposition depends on the chemical composition of detritus (e.g., lignin content).
- (C) is incorrect: Water-soluble organic nutrients are leached into the soil but do not precipitate.
- (D) is correct: Humification occurs after mineralisation.

Quick Tip

Decomposition is aerobic. Humification follows mineralisation in organic matter breakdown.

Q40: 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 soil at a given time.
- (B) Secondary productivity: Rate at which consumers produce organic matter.
- (C) Standing crop: Mass of living matter in a specific trophic level.
- (D) Net primary productivity: Biomass available for heterotroph consumption.

Quick Tip

Standing state → Nutrients. Secondary productivity → Consumer biomass formation. Standing crop → Living mass. NPP → Heterotroph biomass.

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.

Q41: 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 vector-borne disease caused by parasitic worms transmitted through mosquito bites. In contrast, Chlamydiasis, Genital herpes, and Trichomoniasis are sexually transmitted diseases.

Quick Tip

Remember: STDs are transmitted via sexual contact, while Filariasis is mosquito-borne.

Q42: 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:
- (1) is correct: MTPs are safe up to 12 weeks (first trimester).
- (2) is correct: The Medical Termination of Pregnancy Act was enacted in India in 1971.
- (3) is correct: MTPs after 24 weeks require special approval for valid medical reasons.
- (4) is incorrect: The actual global percentage of pregnancies undergoing MTP is significantly lower.

Quick Tip

MTP is regulated, and the global figure of 20% is exaggerated.

Q43: 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 tub
(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 with up to 8 blastomeres into the fallopian tube.
- ICSI: Formation of embryos in vitro by direct injection of sperm into the ovum.
- IUI: Artificial insemination of semen into the uterus.
- IUT: Transfer of embryos with more than 8 blastomeres into the uterus.

Quick Tip

Key ART techniques:
- ZIFT → Early embryo (fallopian tube).
- ICSI → Direct sperm injection.
- IUI → Semen transfer.
- IUT → Advanced embryo (uterus).

Q44: 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, involving the surgical cutting or sealing of the vas deferens to prevent sperm release.

Quick Tip

Vasectomy is a male-specific contraceptive. Other listed methods are suitable for females.

Q45: *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: The *Saheli* pill, developed by the Central Drug Research Institute (CDRI), Lucknow, is a unique non-steroidal contraceptive that is taken once a week.

Quick Tip

Saheli is India's non-steroidal 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.

Q46: 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 community, not all species have equal importance. Keystone species often have a disproportionately large impact on community stability, while others may play minor roles.

Quick Tip

Key species play crucial roles in community stability, but not all species are equally important.

Q47: 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 the loss of too many species may lead to collapse.

Quick Tip

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

Q48: 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 changes.

Quick Tip

David Tilman: Species richness enhances ecosystem stability.

Q49: 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 known species. They occupy diverse aquatic habitats worldwide.

Quick Tip

Fishes dominate among vertebrates; insects dominate among invertebrates.

Q50: The following are the various hypotheses proposed in explaining the greatest biological diversity in 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 contribute to tropical diversity, other factors like stability, solar energy, and lack of glaciation are more significant.

Quick Tip

Tropical biodiversity: Stability, constant climate, and abundant energy are key contributors.