

AIIMS Paramedical Biology

Sample Paper – 10

Duration: 30 Minutes

Maximum Marks: 30

Instructions

- This paper contains **30** Multiple Choice Questions (Single Correct Answer), modelled on the Biology portion of **AIIMS Paramedical** entrance.
- Each correct answer carries **+1 mark**. Each incorrect answer carries **a penalty of $-\frac{1}{3}$ mark**. Unattempted questions carry **0 marks**.
- Only **one** option is correct. Choose carefully.
- Syllabus level: **Class 11 & 12 NCERT Biology**
- Use of mobile phones, calculators, or electronic gadgets is strictly prohibited.

Q1. In the taxonomic hierarchy, the categories that lie *above* the level of species are collectively called higher taxa. Which of the following sequences correctly arranges these higher categories in increasing order of rank?

- (A) Genus → Family → Order → Class → Phylum → Kingdom
- (B) Genus → Order → Family → Class → Kingdom → Phylum
- (C) Family → Genus → Order → Phylum → Class → Kingdom
- (D) Kingdom → Phylum → Class → Order → Family → Genus

Q2. A taxonomic key used for the identification of plants and animals is based on a special arrangement of contrasting characters. Each step in such a key offers two opposing choices, and each pair of contrasting statements is technically known as a:

- (A) Taxon



- (B) Couplet (made of two leads)
- (C) Monograph
- (D) Herbarium label

Q3. Lichens and mycorrhizae are both classic examples of mutually beneficial symbiotic associations involving fungi. Which statement correctly describes the partners involved?

- (A) In a lichen the fungus prepares food while the alga absorbs water
- (B) A mycorrhiza is an association between a fungus and a blue-green alga
- (C) In a lichen, the algal partner photosynthesises and the fungal partner absorbs water and minerals; a mycorrhiza is a fungus–root association
- (D) Both lichen and mycorrhiza are associations between two different fungi

Q4. Systems used for classifying angiosperms are often described as artificial, natural or phylogenetic. A system that is built using evolutionary relationships and reflects the descent of plants from common ancestors is best described as a:

- (A) Artificial system based on one or a few vegetative characters
- (B) Numerical system using only floral symmetry
- (C) Natural system based purely on habitat
- (D) Phylogenetic system based on evolutionary relationships

Q5. Animals are classified on the basis of certain fundamental features. An animal whose body can be divided into two identical halves by any plane passing through the central axis shows which type of body symmetry?

- (A) Radial symmetry
- (B) Bilateral symmetry



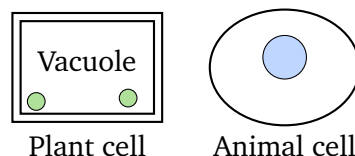
- (C) Asymmetry
- (D) Pseudometameric symmetry

Q6. The floral formula given below belongs to a particular plant family that includes *Pisum sativum* (garden pea):

$$\% \oplus K_{(5)} C_{1+2+(2)} A_{(9)+1} \underline{G}_1$$

The vexillary (papilionaceous) aestivation and diadelphous stamens indicate that this plant belongs to the family:

- (A) Fabaceae (Papilionoideae)
 - (B) Solanaceae
 - (C) Liliaceae
 - (D) Brassicaceae
- Q7.** Specialised junctions hold epithelial cells together and allow communication between them. Which junction provides a channel that allows the rapid passage of ions and small molecules from the cytoplasm of one cell directly into the next?
- (A) Tight junction
 - (B) Gap junction
 - (C) Adhering junction (desmosome)
 - (D) Hemidesmosome
- Q8.** The TikZ figures below represent a plant cell (left) and an animal cell (right).



Which set of structures is present in the plant cell but *absent* in a typical animal cell?



- (A) Ribosomes and mitochondria
- (B) Nucleus and endoplasmic reticulum
- (C) Cell wall, large central vacuole and plastids (chloroplasts)
- (D) Golgi apparatus and lysosomes

Q9. Biomolecules in a cell are grouped into primary and secondary metabolites. Which of the following is a *secondary* metabolite?

- (A) Amino acids
- (B) Glucose
- (C) Nucleotides
- (D) Morphine (an alkaloid)

Q10. Water moving across the root toward the xylem can travel either through the cell walls and intercellular spaces, or from cytoplasm to cytoplasm through plasmodesmata. The pathway that passes through the cell walls and spaces *without crossing any membrane* is the:

- (A) Symplast pathway
- (B) Apoplast pathway
- (C) Transmembrane (vacuolar) pathway
- (D) Phloem loading pathway

Q11. In the light reactions of photosynthesis, two pigment systems are involved. The reaction centre of Photosystem I (PS I) absorbs light maximally at a wavelength of about:

- (A) 700 nm (P700)
- (B) 680 nm (P680)
- (C) 420 nm
- (D) 540 nm



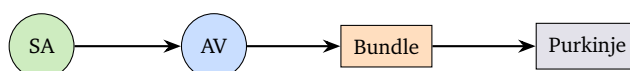
Q12. The respiratory pathway is often called an amphibolic pathway because it serves in both breakdown and biosynthesis. According to the conventional balance sheet, the complete aerobic oxidation of one molecule of glucose yields a net total of approximately:

- (A) 2 ATP
- (B) 36–38 ATP
- (C) 4 ATP
- (D) 100 ATP

Q13. Protein–energy malnutrition produces characteristic deficiency disorders in children. The condition resulting chiefly from a severe deficiency of *protein* (with adequate or near-adequate calories), marked by oedema (swelling) and a swollen belly, is known as:

- (A) Marasmus
- (B) Rickets
- (C) Kwashiorkor
- (D) Scurvy

Q14. The conducting system of the human heart sets the rhythm of the heartbeat. The simplified TikZ diagram shows the path of the impulse:



The structure that initiates each heartbeat and is therefore called the natural pacemaker of the heart is the:

- (A) Purkinje fibres
- (B) Bundle of His
- (C) Atrioventricular (AV) node
- (D) Sinoatrial (SA) node

Q15. The hypothalamus controls the secretions of the anterior pituitary through releasing and inhibiting hormones. These hypothalamic hormones reach



the anterior pituitary mainly through a special blood connection called the:

- (A) Hypothalamo–hypophyseal portal system
- (B) Hepatic portal vein
- (C) Coronary circulation
- (D) Renal portal system

Q16. Many plants are propagated artificially by horticulturists without using seeds. Which of the following is an *artificial* (man-made) method of vegetative propagation?

- (A) Production of offsets by water hyacinth
- (B) Formation of bulbils in *Agave*
- (C) Cutting and grafting of stems
- (D) Buds on leaf margins of *Bryophyllum*

Q17. After fertilisation, the zygote undergoes rapid mitotic divisions called cleavage. The hollow, fluid-filled, ball-like structure with an inner cell mass that finally implants in the uterine wall is the:

- (A) Morula
- (B) Blastocyst
- (C) Gastrula
- (D) Zygote

Q18. Contraceptive methods are grouped as natural, barrier, intra-uterine and surgical. Which of the following is a *surgical* method of contraception (sterilisation)?

- (A) Use of a condom
- (B) The rhythm (periodic abstinence) method
- (C) Vasectomy and tubectomy



(D) Copper-T (IUD)

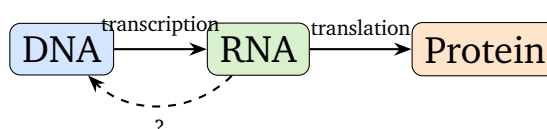
Q19. In a normal dihybrid cross between two genes, the F_2 phenotypic ratio is 9:3:3:1. When one gene masks or suppresses the phenotypic expression of another, non-allelic gene, the phenomenon is called:

- (A) Incomplete dominance
- (B) Co-dominance
- (C) Multiple allelism
- (D) Epistasis

Q20. Mutations may occur at the gene level or at the chromosome level. A change in the chromosome number caused by the loss or gain of a single chromosome (for example $2n - 1$ or $2n + 1$) is termed:

- (A) Polyploidy
- (B) Aneuploidy
- (C) Point mutation
- (D) Frameshift mutation

Q21. The central dogma describes the flow of genetic information, shown below in TikZ:



The dashed reverse arrow ($\text{RNA} \rightarrow \text{DNA}$), seen in retroviruses, represents the process of:

- (A) Reverse transcription (catalysed by reverse transcriptase)
- (B) Replication
- (C) Translation
- (D) Splicing



- Q22.** In eukaryotes, the primary transcript (hnRNA) is processed before it leaves the nucleus. The post-transcriptional step in which the non-coding introns are removed and the coding exons are joined together is called:
- (A) Capping
 - (B) Splicing
 - (C) Tailing (polyadenylation)
 - (D) Methylation
- Q23.** Natural selection can act on a varying population in different ways. The type of selection in which both the extreme phenotypes are favoured and the intermediate forms are eliminated, splitting the population into two, is called:
- (A) Stabilising selection
 - (B) Directional selection
 - (C) Disruptive selection
 - (D) Artificial selection
- Q24.** Lymphoid organs are grouped as primary and secondary. Which pair below correctly lists the *primary* lymphoid organs, where lymphocytes mature and become immunocompetent?
- (A) Spleen and lymph nodes
 - (B) Tonsils and Peyer's patches
 - (C) Spleen and thymus
 - (D) Bone marrow and thymus
- Q25.** Innate immunity provides the body's first line of defence. Virus-infected cells secrete certain proteins that protect the neighbouring uninfected cells from further viral attack. These proteins are called:
- (A) Histamines
 - (B) Antibodies



(C) Interferons

(D) Antigens

Q26. The fermentation of malted cereals and fruit juices to produce alcoholic beverages such as beer and wine is carried out by a microbe popularly known as brewer's yeast. This organism is:

(A) *Saccharomyces cerevisiae*

(B) *Lactobacillus*

(C) *Aspergillus niger*

(D) *Clostridium butylicum*

Q27. While constructing a recombinant DNA, a cloning vector must carry a selectable marker that helps in identifying and eliminating non-transformants. A commonly used selectable marker in vectors such as pBR322 is a gene for:

(A) Origin of replication (ori)

(B) Antibiotic resistance (e.g. resistance to ampicillin)

(C) A restriction site

(D) A promoter sequence

Q28. Transgenic crops have been developed for improved nutrition and longer shelf life. Which transgenic plant was developed by enriching it with pro-vitamin A (β -carotene) to combat vitamin A deficiency?

(A) Flavr Savr tomato

(B) Bt cotton

(C) Bt brinjal

(D) Golden rice

Q29. Gause's competitive exclusion principle deals with interspecific competition between two species. The principle states that two closely related species competing for the same limited resources:



- (A) Always live together permanently without any effect
- (B) Cannot coexist indefinitely; the competitively inferior one is eventually eliminated
- (C) Both go extinct at the same time
- (D) Form a permanent mutualistic relationship

Q30. Healthy ecosystems provide many products and services that are essential to human life. Which of the following is best described as an *ecosystem service* of biodiversity?

- (A) Purification of air and water, pollination of crops and climate moderation
- (B) Increase in atmospheric carbon dioxide
- (C) Loss of fertile topsoil
- (D) Spread of invasive weed species



Detailed Solutions**Q1.****Solution**

Concept — Taxonomic hierarchy: Taxonomic categories are arranged in a definite hierarchy. Species is the lowest (basic) unit, and the categories placed above it are called higher taxa.

Step 1 — Recall the ascending order: The ascending sequence above species is Genus, Family, Order, Class, Phylum (or Division), Kingdom.

Step 2 — Match with the options: Option (A) gives exactly this order: Genus → Family → Order → Class → Phylum → Kingdom.

Why other options are wrong:

- Option (B): Order is wrongly placed below Family, and Kingdom below Phylum.
- Option (C): Genus appears after Family, which is incorrect.
- Option (D): This is the descending order, not increasing rank.

Final Answer: Increasing order is Genus to Kingdom ⇒ A

Answer: (A) [Go Back to Q1](#)

Q2.**Solution**

Concept — Taxonomic keys: A taxonomic key is an analytical tool used for identification based on contrasting characters arranged in pairs.

Step 1 — Structure of a key: Each step offers two opposite choices. The pair of contrasting statements at each step is called a *couplet*.

Step 2 — Components: Each statement of a couplet is called a *lead*. So a couplet is made of two leads.

Why other options are wrong:

- Option (A): A taxon is a unit of classification, not a step in a key.
- Option (C): A monograph is a complete account of a single taxon.
- Option (D): A herbarium label records collection data, not key choices.

Final Answer: The contrasting pair is a couplet ⇒ B



Answer: (B) [Go Back to Q2](#)

Q3.

Solution

Concept — Symbiotic associations of fungi: Lichens and mycorrhizae are both mutualistic associations in which a fungus partners with a photosynthetic organism or a plant root.

Step 1 — Lichen: A lichen is an association of an alga (or cyanobacterium) and a fungus. The algal partner makes food by photosynthesis, while the fungal partner provides shelter and absorbs water and minerals.

Step 2 — Mycorrhiza: A mycorrhiza is an association between a fungus and the roots of higher plants; the fungus helps the plant absorb minerals and water.

Why other options are wrong:

- Option (A): Reverses the roles; the alga makes food, not the fungus.
- Option (B): A mycorrhiza is a fungus–root, not fungus–alga, association.
- Option (D): Neither association is between two fungi.

Final Answer: Alga photosynthesises in lichen; mycorrhiza is fungus–root $\Rightarrow$ **C**

Answer: (C) [Go Back to Q3](#)

Q4.

Solution

Concept — Systems of classification: Classification systems evolved from artificial (few characters), to natural (many characters), to phylogenetic (evolutionary relationships).

Step 1 — Phylogenetic system: A phylogenetic system is based on evolutionary relationships and assumes that organisms of the same taxa share a common ancestor.

Step 2 — Match: Option (D) describes a phylogenetic system exactly.

Why other options are wrong:

- Option (A): An artificial system uses only one or a few easily seen characters.
- Option (B): Numerical (using only symmetry) is not phylogenetic.
- Option (C): Habitat alone does not show evolutionary descent.



Final Answer: A system based on evolutionary relationships is phylogenetic $\Rightarrow$ D

Answer: (D) [Go Back to Q4](#)

Q5.

Solution

Concept — Symmetry in animals: Body symmetry is one of the basic features used to classify animals.

Step 1 — Radial symmetry: If any plane passing through the central axis divides the body into two identical halves, the animal has radial symmetry (for example *Hydra* and starfish).

Step 2 — Compare with bilateral: In bilateral symmetry, only one particular plane divides the body into identical right and left halves.

Why other options are wrong:

- Option (B): Bilateral needs a single specific plane, not any plane.
- Option (C): Asymmetry means no plane divides the body equally.
- Option (D): Pseudometameric symmetry is not a recognised symmetry type.

Final Answer: Division by any plane through the axis is radial symmetry $\Rightarrow$ A

Answer: (A) [Go Back to Q5](#)

Q6.

Solution

Concept — Floral formula and family: A floral formula summarises the structure of a flower, and characteristic features point to a family.

Step 1 — Read the cues: Zygomorphic symmetry, calyx of 5 fused sepals, papilionaceous corolla ($1 + 2 + (2)$), and diadelphous stamens $(9) + 1$ with a single superior carpel are diagnostic of the pea sub-family.

Step 2 — Identify the family: *Pisum sativum* (pea) belongs to family Fabaceae (sub-family Papilionoideae).

Why other options are wrong:

- Option (B): Solanaceae has actinomorphic flowers with 5 epipetalous stamens.



- Option (C): Liliaceae is a monocot family with a trimerous perianth.
- Option (D): Brassicaceae has a cruciform corolla and tetradynamous stamens.

Final Answer: Pea family with diadelphous stamens is Fabaceae $\Rightarrow$ **A**

Answer: (A) [Go Back to Q6](#)

Q7.

Solution

Concept — Cell junctions: Epithelial cells are held together by tight junctions, adhering junctions and gap junctions.

Step 1 — Function of a gap junction: A gap junction connects the cytoplasm of adjacent cells through tiny channels, allowing the rapid transfer of ions and small molecules.

Step 2 — Contrast: Tight junctions seal cells to stop leakage; adhering junctions (desmosomes) cement cells together.

Why other options are wrong:

- Option (A): A tight junction prevents the passage of substances, it does not allow it.
- Option (C): A desmosome provides mechanical strength only.
- Option (D): A hemidesmosome anchors a cell to the basement membrane.

Final Answer: The channel for ions and small molecules is the gap junction $\Rightarrow$ **B**

Answer: (B) [Go Back to Q7](#)

Q8.

Solution

Concept — Plant vs animal cell: Plant and animal cells share many organelles, but a few structures are unique to plant cells.

Step 1 — Plant-specific structures: A rigid cell wall, a large central vacuole, and plastids (including chloroplasts) are present in plant cells.

Step 2 — Animal cells: These three structures are typically absent in animal cells, which instead have centrioles and small vacuoles.

Why other options are wrong:



- Option (A): Ribosomes and mitochondria are present in both cell types.
- Option (B): Nucleus and endoplasmic reticulum occur in both.
- Option (D): Golgi apparatus and lysosomes occur in both.

Final Answer: Cell wall, central vacuole and plastids are plant-specific $\Rightarrow$ C

Answer: (C) [Go Back to Q8](#)

Q9.

Solution

Concept — Primary vs secondary metabolites: Primary metabolites take part directly in growth, development and reproduction (for example amino acids, sugars, nucleotides). Secondary metabolites have no obvious direct role in these basic processes.

Step 1 — Examples of secondary metabolites: Alkaloids (morphine), flavonoids, rubber, essential oils, and toxins are secondary metabolites.

Step 2 — Classify the options: Morphine is an alkaloid and hence a secondary metabolite.

Why other options are wrong:

- Option (A): Amino acids are primary metabolites.
- Option (B): Glucose is a primary metabolite.
- Option (C): Nucleotides are primary metabolites.

Final Answer: Morphine, an alkaloid, is a secondary metabolite $\Rightarrow$ D

Answer: (D) [Go Back to Q9](#)

Q10.

Solution

Concept — Pathways of water movement: Water crosses the root cortex by the apoplast and symplast pathways.

Step 1 — Apoplast pathway: The apoplast is the system of cell walls and inter-cellular spaces. Water moving here does not cross any plasma membrane.

Step 2 — Symplast pathway: In the symplast, water travels from cytoplasm to cytoplasm through plasmodesmata, crossing membranes initially.

Why other options are wrong:



- Option (A): The symplast involves passage through cytoplasm and membranes.
- Option (C): The transmembrane pathway crosses membranes and vacuoles.
- Option (D): Phloem loading is a sugar transport process, not root water uptake.

Final Answer: Movement through walls without crossing membranes is apoplast

⇒ **B**

Answer: (B) [Go Back to Q10](#)

Q11.

Solution

Concept — Photosystems: The light reactions involve two pigment systems, PS I and PS II, each with a reaction-centre chlorophyll that absorbs at a characteristic wavelength.

Step 1 — PS I: The reaction centre of Photosystem I absorbs light maximally at about 700 nm and is therefore named P700.

Step 2 — PS II: The reaction centre of Photosystem II absorbs at about 680 nm (P680).

Why other options are wrong:

- Option (B): 680 nm (P680) belongs to PS II, not PS I.
- Option (C): 420 nm lies in the violet-blue region, not the PS I peak.
- Option (D): 540 nm is in the green region, weakly absorbed.

Final Answer: PS I reaction centre is P700 ⇒ **A**

Answer: (A) [Go Back to Q11](#)

Q12.

Solution

Concept — Respiratory balance sheet: Aerobic respiration of glucose proceeds through glycolysis, the Krebs cycle and the electron transport chain.

Step 1 — Net yield: The conventional balance sheet for one glucose molecule gives a net of about 36 to 38 ATP.

Step 2 — Amphibolic nature: The pathway is amphibolic because its intermedi-



ates serve both catabolic (breakdown) and anabolic (synthesis) roles.

Why other options are wrong:

- Option (A): 2 ATP is the anaerobic (fermentation) net yield only.
- Option (C): 4 ATP is the gross yield of glycolysis before deductions.
- Option (D): 100 ATP is far too high.

Final Answer: Complete aerobic oxidation gives about 36–38 ATP $\Rightarrow$ **B**

Answer: (B) [Go Back to Q12](#)

Q13.

Solution

Concept — Protein–energy malnutrition: Deficiency of protein and calories produces kwashiorkor and marasmus.

Step 1 — Kwashiorkor: Results from severe *protein* deficiency with adequate calories. It shows oedema, a swollen belly, stunted growth and a moon face.

Step 2 — Contrast with marasmus: Marasmus results from a deficiency of *both* protein and calories, giving extreme thinness and wasting of muscles.

Why other options are wrong:

- Option (A): Marasmus lacks oedema and involves calorie deficiency too.
- Option (B): Rickets is due to vitamin D deficiency.
- Option (D): Scurvy is due to vitamin C deficiency.

Final Answer: Protein deficiency with oedema is kwashiorkor $\Rightarrow$ **C**

Answer: (C) [Go Back to Q13](#)

Q14.

Solution

Concept — Conducting system of the heart: The impulse travels SA node $\rightarrow$ AV node $\rightarrow$ Bundle of His $\rightarrow$ Purkinje fibres.

Step 1 — Pacemaker: The sinoatrial (SA) node, located in the right atrium, generates the impulse for each heartbeat and is called the natural pacemaker.

Step 2 — Onward path: The impulse then reaches the AV node, passes down the Bundle of His and finally spreads through the Purkinje fibres to the ventricles.



Why other options are wrong:

- Option (A): Purkinje fibres distribute the impulse, they do not initiate it.
- Option (B): The Bundle of His only conducts the impulse to the ventricles.
- Option (C): The AV node relays and delays the impulse, it does not start it.

Final Answer: The natural pacemaker is the SA node $\Rightarrow$ **D**

Answer: (D) [Go Back to Q14](#)

Q15.

Solution

Concept — Hypothalamus–pituitary axis: The hypothalamus regulates the anterior pituitary using releasing and inhibiting hormones.

Step 1 — The connection: These hormones travel from the hypothalamus to the anterior pituitary through a special set of blood vessels called the hypothalamo–hypophyseal portal system.

Step 2 — Significance: This portal system ensures that the hormones reach the anterior pituitary directly in high concentration.

Why other options are wrong:

- Option (B): The hepatic portal vein carries blood from the gut to the liver.
- Option (C): Coronary circulation supplies the heart muscle.
- Option (D): Humans do not have a functional renal portal system as in lower vertebrates.

Final Answer: The link is the hypothalamo–hypophyseal portal system $\Rightarrow$ **A**

Answer: (A) [Go Back to Q15](#)

Q16.

Solution

Concept — Vegetative propagation: Vegetative propagation may be natural (off-sets, bulbils, leaf buds) or artificial (man-made methods used in horticulture).

Step 1 — Artificial methods: Cutting, layering, grafting and tissue culture are artificial methods performed by humans.

Step 2 — Identify: Among the options, cutting and grafting of stems is the arti-



cial method.

Why other options are wrong:

- Option (A): Offsets in water hyacinth form naturally.
- Option (B): Bulbils in *Agave* are a natural method.
- Option (D): Leaf-margin buds in *Bryophyllum* arise naturally.

Final Answer: Cutting and grafting are artificial methods $\Rightarrow$ C

Answer: (C) [Go Back to Q16](#)

Q17.

Solution

Concept — Early embryonic development: After fertilisation the zygote divides by cleavage to form a morula and then a blastocyst.

Step 1 — Blastocyst: The blastocyst is a hollow, fluid-filled ball of cells with an outer trophoblast and an inner cell mass.

Step 2 — Implantation: It is the blastocyst that implants into the uterine wall.

Why other options are wrong:

- Option (A): The morula is a solid ball of cells formed before the blastocyst.
- Option (C): The gastrula forms later, during gastrulation.
- Option (D): The zygote is the single fertilised cell.

Final Answer: The implanting hollow structure is the blastocyst $\Rightarrow$ B

Answer: (B) [Go Back to Q17](#)

Q18.

Solution

Concept — Contraceptive methods: These are natural, barrier, intra-uterine, hormonal and surgical methods.

Step 1 — Surgical methods: Sterilisation is a surgical method; in males it is vasectomy and in females it is tubectomy.

Step 2 — Identify: Vasectomy and tubectomy are surgical methods of contraception.



Why other options are wrong:

- Option (A): A condom is a barrier method.
- Option (B): The rhythm method is a natural method.
- Option (D): The Copper-T is an intra-uterine device.

Final Answer: The surgical method is vasectomy and tubectomy $\Rightarrow$

Answer: (C) [Go Back to Q18](#)

Q19.

Solution

Concept — Deviations from the dihybrid ratio: A normal dihybrid cross gives 9:3:3:1 in the F_2 . Gene interactions modify this ratio.

Step 1 — Epistasis: When one gene masks or suppresses the expression of another non-allelic gene, the phenomenon is called epistasis, modifying the 9:3:3:1 ratio.

Step 2 — Example: In epistasis, ratios such as 9:3:4 or 12:3:1 may appear.

Why other options are wrong:

- Option (A): Incomplete dominance involves alleles of the same gene.
- Option (B): Co-dominance also involves alleles of one gene.
- Option (C): Multiple allelism is about more than two alleles of one gene.

Final Answer: One gene masking another is epistasis $\Rightarrow$

Answer: (D) [Go Back to Q19](#)

Q20.

Solution

Concept — Chromosomal mutations: Changes in chromosome number are classed as euploidy and aneuploidy.

Step 1 — Aneuploidy: Aneuploidy is the gain or loss of one or a few chromosomes, giving conditions like $2n - 1$ (monosomy) or $2n + 1$ (trisomy).

Step 2 — Examples: Down syndrome ($2n + 1$) is an example of aneuploidy.

Why other options are wrong:



- Option (A): Polyploidy is the addition of whole chromosome sets.
- Option (C): A point mutation is a change in a single base of DNA.
- Option (D): A frameshift mutation is due to insertion or deletion of bases.

Final Answer: Loss or gain of a single chromosome is aneuploidy $\Rightarrow$ **B**

Answer: (B) [Go Back to Q20](#)

Q21.

Solution

Concept — Central dogma: The usual flow of information is $\text{DNA} \rightarrow \text{RNA} \rightarrow \text{Protein}$, proposed by Francis Crick.

Step 1 — Reverse flow: In retroviruses, information can flow backward from RNA to DNA. This is reverse transcription.

Step 2 — Enzyme: The enzyme reverse transcriptase catalyses the synthesis of DNA from an RNA template.

Why other options are wrong:

- Option (B): Replication is DNA copying DNA.
- Option (C): Translation is RNA to protein.
- Option (D): Splicing removes introns from the transcript.

Final Answer: $\text{RNA} \rightarrow \text{DNA}$ is reverse transcription $\Rightarrow$ **A**

Answer: (A) [Go Back to Q21](#)

Q22.

Solution

Concept — Post-transcriptional processing: In eukaryotes the hnRNA undergoes capping, tailing and splicing before becoming mRNA.

Step 1 — Splicing: Splicing is the removal of non-coding introns and the joining of coding exons.

Step 2 — Other steps: Capping adds methyl guanosine at the 5' end, and tailing adds a poly-A tail at the 3' end.

Why other options are wrong:

- Option (A): Capping is the addition of a cap at the 5' end.



- Option (C): Tailing adds a poly-A tail, it does not remove introns.
- Option (D): Methylation is a different chemical modification.

Final Answer: Removal of introns and joining of exons is splicing $\Rightarrow$ **B**

Answer: (B) [Go Back to Q22](#)

Q23.

Solution

Concept — Types of natural selection: Selection may be stabilising, directional or disruptive.

Step 1 — Disruptive selection: Disruptive selection favours both extreme phenotypes and removes intermediate types, splitting the population into two groups.

Step 2 — Result: It can lead to a bimodal distribution of traits in the population.

Why other options are wrong:

- Option (A): Stabilising selection favours the intermediate (mean) phenotype.
- Option (B): Directional selection favours one extreme phenotype only.
- Option (D): Artificial selection is carried out by humans, not nature.

Final Answer: Selection favouring both extremes is disruptive $\Rightarrow$ **C**

Answer: (C) [Go Back to Q23](#)

Q24.

Solution

Concept — Lymphoid organs: Lymphoid organs are primary or secondary depending on their role in lymphocyte development.

Step 1 — Primary organs: The bone marrow and the thymus are the primary lymphoid organs where lymphocytes mature and become immunocompetent.

Step 2 — Secondary organs: The spleen, lymph nodes, tonsils and Peyer's patches are secondary lymphoid organs that provide sites for interaction with antigens.

Why other options are wrong:

- Option (A): Spleen and lymph nodes are secondary organs.



- Option (B): Tonsils and Peyer's patches are secondary organs.
- Option (C): The spleen is secondary, so this pair is incorrect.

Final Answer: The primary lymphoid organs are bone marrow and thymus ⇒ D

Answer: (D) [Go Back to Q24](#)

Q25.

Solution

Concept — Innate immunity: Innate immunity is non-specific and includes physical, physiological, cellular and cytokine barriers.

Step 1 — Interferons: Virus-infected cells secrete proteins called interferons that protect neighbouring uninfected cells from viral attack.

Step 2 — Role: Interferons are part of the cytokine barrier of innate immunity.

Why other options are wrong:

- Option (A): Histamines are released during inflammation and allergy.
- Option (B): Antibodies belong to acquired (specific) immunity.
- Option (D): An antigen triggers an immune response, it does not protect cells.

Final Answer: The protective proteins are interferons ⇒ C

Answer: (C) [Go Back to Q25](#)

Q26.

Solution

Concept — Microbes in alcohol production: Fermentation of sugars to alcohol is carried out by yeast.

Step 1 — Brewer's yeast: *Saccharomyces cerevisiae*, called brewer's yeast, ferments malted cereals and fruit juices to produce beer and wine.

Step 2 — Product: It converts sugars into ethanol and carbon dioxide.

Why other options are wrong:

- Option (B): *Lactobacillus* converts milk to curd.
- Option (C): *Aspergillus niger* is used to produce citric acid.
- Option (D): *Clostridium butylicum* produces butyric acid.



Final Answer: Brewer's yeast is *Saccharomyces cerevisiae* $\Rightarrow$ A

Answer: (A) [Go Back to Q26](#)

Q27.

Solution

Concept — Selectable markers: A cloning vector must allow selection of transformed cells from non-transformed ones.

Step 1 — Antibiotic resistance: Genes for antibiotic resistance, such as resistance to ampicillin or tetracycline, act as selectable markers in vectors like pBR322.

Step 2 — Use: Only cells carrying the vector survive on a medium containing the antibiotic, so transformants can be selected.

Why other options are wrong:

- Option (A): The ori controls copy number, it is not a selectable marker.
- Option (C): A restriction site is where DNA is cut, not a marker.
- Option (D): A promoter drives transcription, it does not select cells.

Final Answer: The selectable marker is antibiotic resistance $\Rightarrow$ B

Answer: (B) [Go Back to Q27](#)

Q28.

Solution

Concept — Transgenic plants: Genetic engineering has produced crops with improved nutrition and shelf life.

Step 1 — Golden rice: Golden rice was engineered to be rich in pro-vitamin A (β -carotene) to combat vitamin A deficiency.

Step 2 — Identify: The vitamin-A-enriched transgenic plant is golden rice.

Why other options are wrong:

- Option (A): The Flavr Savr tomato was engineered for longer shelf life.
- Option (B): Bt cotton is engineered for insect resistance.
- Option (C): Bt brinjal is engineered for pest resistance.

Final Answer: The pro-vitamin A crop is golden rice $\Rightarrow$ D

Answer: (D) [Go Back to Q28](#)



Q29.

Solution

Concept — Competitive exclusion: Gause's principle deals with two species competing for the same limited resources.

Step 1 — The principle: It states that two closely related species competing for the same limited resources cannot coexist indefinitely; the competitively inferior species is eliminated.

Step 2 — Example: *Paramecium* experiments by Gause demonstrated this exclusion.

Why other options are wrong:

- Option (A): Permanent coexistence without effect contradicts the principle.
- Option (C): Both species do not go extinct together.
- Option (D): Competition is not a mutualistic relationship.

Final Answer: The inferior competitor is eventually eliminated $\Rightarrow$ **B**

Answer: (B) [Go Back to Q29](#)

Q30.

Solution

Concept — Ecosystem services: Biodiversity-rich ecosystems provide products and services essential for life.

Step 1 — Ecosystem services: These include purification of air and water, pollination of crops, nutrient cycling and climate moderation.

Step 2 — Identify: Option (A) lists genuine ecosystem services of biodiversity.

Why other options are wrong:

- Option (B): A rise in carbon dioxide is a harmful effect, not a service.
- Option (C): Loss of topsoil is environmental damage, not a service.
- Option (D): Spread of invasive weeds harms biodiversity.

Final Answer: Air/water purification, pollination and climate control are ecosystem services $\Rightarrow$ **A**

Answer: (A) [Go Back to Q30](#)



Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	2	B	3	C	4	D	5	A
6	A	7	B	8	C	9	D	10	B
11	A	12	B	13	C	14	D	15	A
16	C	17	B	18	C	19	D	20	B
21	A	22	B	23	C	24	D	25	C
26	A	27	B	28	D	29	B	30	A

