

AIIMS Paramedical Biology

Sample Paper – 5

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 attracts a penalty of $-\frac{1}{3}$ mark; an unattempted question carries **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 five-kingdom and modern systems of classification, organisms that do not fit neatly into the kingdom scheme include viruses, viroids and lichens. Which of the following statements about them is correct?

- (A) Viruses are placed in Kingdom Monera because they contain nucleic acid.
- (B) Viroids are infectious agents made of a small protein coat without nucleic acid.
- (C) Lichens are a symbiotic association between an alga and a fungus and are not placed in any single kingdom.
- (D) Viruses are living cells with their own ribosomes and metabolic machinery.

Q2. According to the rules of binomial nomenclature for writing scientific names, which option is written and represented correctly?



- (A) *Mangifera indica* — printed in italics, genus capitalised, species in lower case.
- (B) *mangifera Indica* — with the species name capitalised.
- (C) *Mangifera indica* — printed in plain upright Roman letters only.
- (D) *Mangifera Indica* — both words beginning with capital letters.

Q3. Archaeobacteria differ from eubacteria in several features. Which feature is characteristic of archaeobacteria?

- (A) Presence of peptidoglycan (murein) in the cell wall.
- (B) A different cell-wall chemistry that allows them to live in extreme habitats such as hot springs and salty areas.
- (C) Complete absence of any cell wall in all forms.
- (D) Presence of a membrane-bound nucleus.

Q4. Angiosperms are divided into monocotyledons and dicotyledons. Which set of features correctly describes a typical dicot?

- (A) One cotyledon, parallel venation and fibrous root system.
- (B) One cotyledon, reticulate venation and tap root system.
- (C) Two cotyledons, parallel venation and fibrous root system.
- (D) Two cotyledons, reticulate venation and tap root system.

Q5. Members of the phylum Annelida show a characteristic body plan. Which of the following is a defining feature of Annelida?

- (A) A pseudocoelom and complete absence of segmentation.
- (B) A true coelom and a body that is metamerically segmented.
- (C) A radially symmetrical body with a water-vascular system.
- (D) An external chitinous exoskeleton with jointed appendages.

Q6. Fruits are classified on the basis of their origin and structure. A fruit that develops from a single ovary of a single flower and whose pericarp is fleshy, such as mango or coconut, is best described as a:



- (A) Aggregate fruit, formed from many ovaries of one flower.
- (B) Composite (multiple) fruit, formed from a whole inflorescence.
- (C) Simple drupe, a single-seeded fleshy fruit with a stony endocarp.
- (D) Parthenocarpic fruit, formed without fertilisation in every case.

Q7. Blood is classified as a connective tissue. Which statement best explains why?

- (A) Its cells (corpuscles) are suspended in an abundant fluid intercellular matrix called plasma.
- (B) Its cells are tightly packed with almost no intercellular material.
- (C) It is made of contractile fibres that bring about movement.
- (D) It lines the inner surface of body cavities as a protective layer.

Q8. A student is asked to match cell organelles with their functions. Which pairing is correct?

- (A) Smooth endoplasmic reticulum — main site of protein synthesis.
- (B) Golgi apparatus — the powerhouse generating most of the ATP.
- (C) Lysosome — packaging and dispatch centre of the cell.
- (D) Rough endoplasmic reticulum — studded with ribosomes and active in protein synthesis.

Q9. Interphase of the cell cycle is divided into three phases. During which phase does DNA replication (synthesis of new DNA) take place?

- (A) G_1 phase, immediately after the previous mitosis.
- (B) S phase, when the DNA content of the cell doubles.
- (C) G_2 phase, just before the cell enters mitosis.
- (D) M phase, when the chromosomes separate.

Q10. Root pressure can push water and minerals to a limited height in a plant, but the main force responsible for the ascent of sap to the top of tall trees is:



- (A) Active pumping of water by xylem parenchyma cells.
- (B) Positive root pressure acting alone throughout the day.
- (C) The transpiration pull (cohesion–tension) generated in the xylem.
- (D) Diffusion of water from cell to cell across the cortex.

Q11. Photorespiration in C_3 plants is considered a wasteful process because:

- (A) RuBisCO acts as an oxygenase, and the pathway consumes energy without producing sugar, ATP or NADPH.
- (B) It produces large amounts of extra glucose at night.
- (C) It fixes additional nitrogen for the plant.
- (D) It occurs only in the dark and releases oxygen.

Q12. Auxins are an important group of plant growth regulators. Which of the following is a well-known role of auxins?

- (A) They induce dormancy and cause closing of stomata under stress.
- (B) They are gaseous regulators that hasten the ripening of fruits.
- (C) They mainly break seed and bud dormancy and promote bolting.
- (D) They promote cell elongation, apical dominance and rooting of stem cuttings.

Q13. The dental formula of an adult human, expressing the teeth of one half of the upper and lower jaw, is:

- (A) $\frac{2123}{2123}$, indicating a total of 28 teeth.
- (B) $\frac{2123}{2123}$, indicating a total of 32 teeth.
- (C) $\frac{2143}{2143}$, indicating a total of 40 teeth.
- (D) $\frac{1212}{1212}$, indicating a total of 24 teeth.

Q14. The human heart shows double circulation. The figure below shows a simplified four-chambered heart with its chambers labelled.



Heart (anterior view)

RA	LA
RV	LV

Which statement about double circulation is correct?

- (A) Oxygenated and deoxygenated blood mix freely in a single ventricle.
- (B) Blood passes through the heart only once in each complete circuit of the body.
- (C) Deoxygenated blood (right side) and oxygenated blood (left side) are kept fully separate, and blood passes through the heart twice per complete circuit.
- (D) The left atrium receives deoxygenated blood from the body through the venae cavae.

Q15. Hormones of the thyroid and pituitary glands regulate many body processes. Which statement is correct?

- (A) Thyroid hormones (thyroxine) require iodine, and their deficiency in adults causes hypothyroidism and goitre.
- (B) The thyroid gland secretes growth hormone and prolactin.
- (C) The pituitary gland secretes thyroxine directly into the blood.
- (D) Excess thyroxine in childhood causes cretinism with stunted growth.

Q16. In most angiosperms the endosperm is formed by triple fusion. The endosperm nucleus is therefore:

- (A) Haploid (n), formed from a single polar nucleus only.
- (B) Triploid ($3n$), formed by fusion of one male gamete with two polar nuclei.



- (C) Diploid ($2n$), formed from the zygote directly.
- (D) Tetraploid ($4n$), formed by fusion of two male gametes with two polar nuclei.

Q17. During the human menstrual cycle, ovulation (release of the ovum) normally occurs:

- (A) On the first day of menstrual bleeding.
- (B) Just before the start of the next menstrual flow.
- (C) Around the middle of the cycle (about day 14 of a 28-day cycle), triggered by a surge of LH.
- (D) Continuously throughout the cycle without any specific timing.

Q18. Reproductive and Child Health (RCH) programmes aim at controlling population growth and improving reproductive health. Which of the following best reflects their main approach?

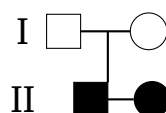
- (A) Making contraception compulsory for every married couple by law.
- (B) Encouraging larger families to increase the future workforce.
- (C) Banning all forms of assisted reproductive technology.
- (D) Creating awareness, providing contraceptive choices and supporting maternal and child care to achieve a smaller, healthier family.

Q19. The phenomenon in which a single gene affects several different and apparently unrelated characters (phenotypic traits) is called:

- (A) Pleiotropy, as seen in phenylketonuria affecting many traits.
- (B) Polygenic inheritance, where many genes control one trait.
- (C) Codominance, where both alleles express fully.
- (D) Incomplete dominance, giving an intermediate phenotype.

Q20. The pedigree below shows the inheritance of a trait. Filled symbols are affected; squares are males and circles are females.





If both children of unaffected parents are affected, the trait is most likely:

- (A) Autosomal dominant, because affected children always have an affected parent.
- (B) Autosomal recessive, because unaffected (carrier) parents can produce affected offspring.
- (C) Y-linked, because it would then appear in every generation in males only.
- (D) Strictly maternally inherited through the cytoplasm.

Q21. The central dogma of molecular biology describes the flow of genetic information, as shown below.



Which RNA carries the genetic message from DNA to the ribosome for protein synthesis?

- (A) tRNA (transfer RNA), which forms part of the ribosome structure.
- (B) rRNA (ribosomal RNA), which brings amino acids to the ribosome.
- (C) mRNA (messenger RNA), which is the template read during translation.
- (D) snRNA, which directly synthesises the polypeptide chain.

Q22. In the Hershey–Chase experiment using bacteriophages, the key conclusion was that:

- (A) Protein, not DNA, is the genetic material of the phage.
- (B) Both DNA and protein are injected equally into the bacterium.



- (C) RNA is the hereditary material in all viruses.
- (D) DNA is the genetic material, since the radioactive phosphorus (^{32}P) labelling the DNA entered the bacterial cells.

Q23. According to Lamarck's theory of evolution, the long neck of the giraffe is explained mainly by:

- (A) Use and disuse of organs and the inheritance of acquired characters.
- (B) Natural selection acting on random variations over generations.
- (C) Sudden large mutations producing long-necked offspring at once.
- (D) Genetic drift in a small founder population.

Q24. A patient is diagnosed with filariasis (elephantiasis). The causative organisms and their mode of spread are:

- (A) *Ascaris lumbricoides*, spread through contaminated food and water.
- (B) *Wuchereria* (filarial worms), transmitted by the bite of female mosquitoes.
- (C) *Plasmodium*, transmitted by the female *Anopheles* mosquito.
- (D) *Entamoeba histolytica*, spread by houseflies acting as carriers.

Q25. Which statement about drug and alcohol abuse is correct?

- (A) Cannabinoids such as those from *Cannabis* mainly stimulate the digestive system.
- (B) Cocaine is an opioid that acts as a strong depressant of the central nervous system.
- (C) Morphine is an opioid obtained from the latex of the poppy plant and is a very effective sedative and painkiller.
- (D) Alcohol has no effect on the liver even with long-term heavy use.

Q26. In microbial biocontrol, which of the following is correctly matched with its use as a biocontrol agent?



- (A) *Bacillus thuringiensis* — produces a toxin used to control insect (butterfly caterpillar) pests.
- (B) *Lactobacillus* — sprayed on crops to kill all insect pests.
- (C) *Penicillium* — a ladybird beetle used against aphids.
- (D) *Trichoderma* — a bacterium that fixes atmospheric nitrogen.

Q27. In recombinant DNA technology, the correct sequence of the basic steps is:

- (A) Insertion into host → cutting of DNA → isolation of DNA → obtaining the product.
- (B) Isolation of DNA → cutting with restriction enzymes → joining (ligation) into a vector and insertion into a host → culturing and obtaining the product.
- (C) Obtaining the product → isolation of DNA → cutting → ligation.
- (D) Cutting with restriction enzymes → obtaining the product → isolation of DNA.

Q28. Transgenic animals are animals whose genome has been altered by introducing a foreign gene. Which of the following is a correct example or use of transgenic animals?

- (A) They are produced only by natural breeding without any gene transfer.
- (B) Their foreign gene can never be passed on to the next generation.
- (C) They are used exclusively to increase the wild population of endangered species.
- (D) Transgenic cows and mice are used to produce useful proteins (such as in milk) and to study human diseases.

Q29. Two species living together where one is benefited and the other is neither harmed nor benefited describes the interaction known as:

- (A) Mutualism (+/+), where both partners gain.



- (B) Competition ($-/-$), where both are harmed.
- (C) Commensalism ($+/0$), as in an orchid growing on a tree branch.
- (D) Parasitism ($+/-$), where one benefits and the other is harmed.

Q30. Regarding global patterns of biodiversity and its loss, which statement is correct?

- (A) Species diversity generally increases as we move from the equator towards the poles.
- (B) Species diversity is highest in the tropics, and habitat loss and fragmentation are major causes of biodiversity loss.
- (C) The introduction of alien (exotic) species always increases native biodiversity.
- (D) The tropical rainforests of the world contain the fewest species on Earth.



Detailed Solutions

Q1.

Solution

Concept — Acellular agents and symbiotic forms: Viruses, viroids and lichens are organisms that do not fit neatly into the kingdom scheme. Viruses are acellular (a nucleic-acid core in a protein coat), viroids are free naked RNA, and lichens are dual organisms.

Step 1 — Examine each item: Viruses are not placed in Monera because they are non-cellular and lack their own ribosomes and metabolism outside a host. Viroids consist of free infectious RNA *without* any protein coat.

Step 2 — Lichens: A lichen is a symbiotic association of an alga (phycobiont) and a fungus (mycobiont); it is therefore not assigned to a single kingdom.

Why other options are wrong:

- Option A: viruses are not in Monera and are non-cellular.
- Option B: viroids are made of naked RNA, not a protein coat.
- Option D: viruses lack their own ribosomes and metabolic machinery.

Final Answer: Lichens are an alga–fungus symbiosis not placed in a single kingdom ⇒

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

Q2.

Solution

Concept — Binomial nomenclature: Each scientific name has two parts: the genus (capitalised) and the species (lower case). The whole name is printed in italics, and when handwritten each word is underlined separately.

Step 1 — Apply the rules: For mango the correct name is *Mangifera indica*: genus capitalised, species in lower case, the whole printed in italics.

Step 2 — Check the options: Only option A follows all rules.

Why other options are wrong:

- Option B: genus must be capitalised, species must be lower case.
- Option C: the name must be in italics (or underlined), not plain upright.
- Option D: the species name must not be capitalised.



Final Answer: *Mangifera indica* written in italics $\Rightarrow$ A

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

Q3.

Solution

Concept — Archaeobacteria: Archaeobacteria are the most ancient bacteria living in some of the harshest habitats (halophiles in salty areas, thermoacidophiles in hot springs, methanogens in marshes).

Step 1 — Cell wall: Their special cell-wall structure (lacking true peptidoglycan) lets them survive these extreme conditions, unlike eubacteria.

Step 2 — Eliminate distractors: Peptidoglycan is typical of eubacteria; archaeobacteria are prokaryotes with no membrane-bound nucleus, and they do possess a wall.

Why other options are wrong:

- Option A: peptidoglycan/murein is a eubacterial feature.
- Option C: archaeobacteria do have a cell wall (of different chemistry).
- Option D: being prokaryotes, they lack a membrane-bound nucleus.

Final Answer: Different wall chemistry suiting extreme habitats $\Rightarrow$ B

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

Q4.

Solution

Concept — Monocots vs dicots: The number of cotyledons in the seed, the venation of leaves and the root system distinguish the two classes of angiosperms.

Step 1 — Dicot features: Two cotyledons, reticulate (net-like) leaf venation, and a tap root system.

Step 2 — Monocot features (for contrast): One cotyledon, parallel venation and a fibrous root system.

Why other options are wrong:

- Options A and C describe monocot features (one cotyledon, parallel venation, fibrous roots).



- Option B mixes one cotyledon with dicot root/venation, which is inconsistent.

Final Answer: Two cotyledons, reticulate venation, tap root $\Rightarrow$ **D**

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

Q5.

Solution

Concept — Phylum Annelida: Annelids (e.g. earthworm, *Nereis*, leech) are the first truly coelomate, metamerically segmented animals with organ-system level organisation.

Step 1 — Body cavity: They possess a true coelom (schizocoelom), not a pseudocoelom.

Step 2 — Segmentation: Their body shows external and internal metameric segmentation into ring-like segments.

Why other options are wrong:

- Option A: pseudocoelom and no segmentation describe Aschelminthes.
- Option C: a water-vascular system is a feature of Echinodermata.
- Option D: a chitinous exoskeleton with jointed legs is a feature of Arthropoda.

Final Answer: True coelom and metameric segmentation $\Rightarrow$ **B**

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

Q6.

Solution

Concept — Types of fruits: A drupe is a simple fleshy fruit developing from a single ovary, with the pericarp differentiated into a skin (epicarp), a fleshy middle (mesocarp) and a hard stony inner layer (endocarp).

Step 1 — Identify the example: Mango and coconut are classic drupes with a stony endocarp enclosing the seed.

Step 2 — Origin: It develops from one ovary of a single flower, hence a *simple* fruit.

Why other options are wrong:



- Option A: aggregate fruits (e.g. strawberry) come from many ovaries of one flower.
- Option B: composite/multiple fruits (e.g. pineapple) come from a whole inflorescence.
- Option D: not all such fruits are parthenocarpic; they normally form after fertilisation.

Final Answer: A simple drupe with a stony endocarp $\Rightarrow$

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

Q7.

Solution

Concept — Connective tissue: Connective tissues are characterised by cells loosely scattered in an abundant intercellular matrix. In blood, this matrix is the fluid plasma.

Step 1 — Components of blood: The formed elements (RBCs, WBCs, platelets) float in plasma, a liquid matrix.

Step 2 — Why connective: Because of this cell-in-matrix arrangement, blood is classed as a fluid (specialised) connective tissue.

Why other options are wrong:

- Option B: tightly packed cells with little matrix describe epithelial tissue.
- Option C: contractile fibres causing movement describe muscular tissue.
- Option D: lining of cavities is a feature of epithelium.

Final Answer: Cells suspended in a fluid plasma matrix $\Rightarrow$

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

Q8.

Solution

Concept — Organelle functions: Each organelle has a defined role: rough ER (with ribosomes) makes proteins, Golgi packages and dispatches them, lysosomes digest, and mitochondria make ATP.

Step 1 — Match correctly: Rough endoplasmic reticulum is studded with ribosomes and is active in protein synthesis.



Step 2 — Reject mismatches: The other options swap the well-known roles.

Why other options are wrong:

- Option A: protein synthesis occurs on the *rough* ER, not the smooth ER.
- Option B: the powerhouse is the mitochondrion, not the Golgi.
- Option C: packaging/dispatch is done by the Golgi, not the lysosome.

Final Answer: Rough ER bears ribosomes and synthesises protein $\Rightarrow$ **D**

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

Q9.

Solution

Concept — Interphase: Interphase has three sub-phases — G_1 (growth and normal functions), S (DNA synthesis) and G_2 (preparation for division).

Step 1 — Locate DNA replication: DNA is copied during the S (synthesis) phase, so the DNA content doubles ($2C \rightarrow 4C$).

Step 2 — Confirm: The chromosome number stays the same, but each chromosome now has two sister chromatids.

Why other options are wrong:

- Option A: in G_1 the cell grows; DNA is not yet replicated.
- Option C: in G_2 the cell prepares for mitosis after replication is done.
- Option D: M phase is mitosis, when chromosomes separate.

Final Answer: DNA replicates in the S phase $\Rightarrow$ **B**

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

Q10.

Solution

Concept — Ascent of sap: Water moves up the xylem mainly by the transpiration-pull mechanism, explained by the cohesion-tension theory.

Step 1 — Transpiration pull: Loss of water vapour from leaves creates a tension (negative pressure) that pulls a continuous water column up the xylem.

Step 2 — Cohesion and adhesion: Hydrogen bonding keeps water molecules cohesive, so the column does not break as it rises.



Why other options are wrong:

- Option A: xylem vessels are dead; they do not actively pump.
- Option B: root pressure raises water only a little and not in tall trees.
- Option D: cell-to-cell diffusion is far too slow to lift sap to treetops.

Final Answer: Transpiration pull (cohesion–tension) $\Rightarrow$

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

Q11.

Solution

Concept — Photorespiration: In C_3 plants the enzyme RuBisCO can bind O_2 instead of CO_2 when oxygen is high, starting the wasteful photorespiratory pathway.

Step 1 — Why wasteful: This pathway does not synthesise sugar; it does not produce ATP or NADPH and even releases previously fixed carbon as CO_2 .

Step 2 — Net effect: It lowers the net photosynthetic efficiency of C_3 plants.

Why other options are wrong:

- Option B: it produces no extra glucose.
- Option C: it does not fix nitrogen.
- Option D: it occurs in the light and consumes oxygen rather than releasing it.

Final Answer: RuBisCO oxygenase activity wastes energy without making sugar $\Rightarrow$

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

Q12.

Solution

Concept — Auxins: Auxins (e.g. IAA) are growth regulators first isolated from coleoptile tips; they govern several growth responses.

Step 1 — Roles of auxin: They promote cell elongation, maintain apical dominance (suppressing lateral buds) and induce rooting in stem cuttings.

Step 2 — Distinguish from others: Each wrong option lists the role of a different regulator.



Why other options are wrong:

- Option A: inducing dormancy and stomatal closure is the role of abscisic acid.
- Option B: hastening fruit ripening as a gas is the role of ethylene.
- Option C: breaking dormancy and bolting are gibberellin effects.

Final Answer: Cell elongation, apical dominance and rooting $\Rightarrow$ **D**

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

Q13.

Solution

Concept — Dental formula: The human dental formula counts incisors, canines, premolars and molars in one half of each jaw, written as $\frac{\text{upper}}{\text{lower}}$.

Step 1 — Write the formula: For an adult it is $\frac{2123}{2123}$ (2 incisors, 1 canine, 2 premolars, 3 molars per half-jaw).

Step 2 — Total count: Each half has 8 teeth; four halves give $8 \times 4 = 32$ teeth.

Why other options are wrong:

- Option A: 28 teeth corresponds to a child/young adult without wisdom teeth.
- Option C: 2143 would give 40 teeth, which is not human.
- Option D: 1212 giving 24 teeth is incorrect for humans.

Final Answer: $\frac{2123}{2123}$ giving 32 teeth $\Rightarrow$ **B**

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

Q14.

Solution

Concept — Double circulation: In humans, blood flows through the heart twice in one complete body circuit — once in the pulmonary circuit and once in the systemic circuit.

Step 1 — Separation of blood: The right side (RA, RV) handles deoxygenated blood; the left side (LA, LV) handles oxygenated blood. The septum keeps them fully separate.



Step 2 — Two passes: Deoxygenated blood goes heart → lungs → heart (pulmonary), then oxygenated blood goes heart → body → heart (systemic).

Why other options are wrong:

- Option A: there is no mixing in a four-chambered mammalian heart.
- Option B: blood passes through the heart twice, not once, per circuit.
- Option D: the left atrium receives *oxygenated* blood from the lungs.

Final Answer: Oxygenated and deoxygenated blood kept separate; two passes per circuit ⇒

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

Q15.

Solution

Concept — Thyroid and pituitary: The thyroid makes iodine-containing hormones (thyroxine, T_4 and T_3) under the control of TSH from the pituitary.

Step 1 — Iodine link: Thyroxine synthesis needs iodine; dietary iodine deficiency in adults leads to hypothyroidism and an enlarged thyroid (goitre).

Step 2 — Check the gland roles: The pituitary secretes TSH (a tropic hormone), not thyroxine itself.

Why other options are wrong:

- Option B: growth hormone and prolactin are pituitary, not thyroid, hormones.
- Option C: the pituitary does not secrete thyroxine directly.
- Option D: *deficiency* of thyroxine in childhood causes cretinism, not excess.

Final Answer: Thyroxine needs iodine; its deficiency causes hypothyroidism and goitre ⇒

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



Q16.

Solution

Concept — Triple fusion: In angiosperms, double fertilisation involves syngamy (forming the zygote) and triple fusion (forming the endosperm).

Step 1 — Triple fusion: One male gamete (n) fuses with the two polar nuclei ($n + n$) of the central cell.

Step 2 — Ploidy: The resulting primary endosperm nucleus is $n + n + n = 3n$ (triploid).

Why other options are wrong:

- Option A: a single polar nucleus would give n , but two are involved.
- Option C: $2n$ describes the zygote, formed by syngamy.
- Option D: only one male gamete (not two) takes part in triple fusion.

Final Answer: Endosperm nucleus is triploid ($3n$) $\Rightarrow$ **B**

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

Q17.

Solution

Concept — Menstrual cycle: The cycle has menstrual, follicular (proliferative), ovulatory and luteal (secretory) phases over about 28 days.

Step 1 — Ovulation timing: Ovulation occurs around mid-cycle (about day 14), when a sharp surge of luteinising hormone (LH) ruptures the mature Graafian follicle.

Step 2 — Release: The secondary oocyte (ovum) is then released into the fallopian tube.

Why other options are wrong:

- Option A: day 1 is the start of menstrual bleeding, not ovulation.
- Option B: just before the next period is the late luteal phase.
- Option D: ovulation is a single mid-cycle event, not continuous.

Final Answer: Ovulation occurs around day 14 due to the LH surge $\Rightarrow$ **C**

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



Q18.

Solution

Concept — RCH and population control: Reproductive and Child Health programmes promote a small, healthy family through awareness, choice and good maternal/child care, not by coercion.

Step 1 — Approach: They create awareness about reproductive health, provide a range of contraceptive options, and strengthen maternal and child-care services.

Step 2 — Goal: A smaller, healthier family that improves overall reproductive health and slows population growth.

Why other options are wrong:

- Option A: contraception is voluntary, not legally compulsory.
- Option B: the aim is to slow growth, not encourage larger families.
- Option C: assisted reproduction (e.g. IVF) is supported, not banned.

Final Answer: Awareness, contraceptive choice and maternal/child care ⇒ **D**

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

Q19.

Solution

Concept — Pleiotropy: When a single gene controls or influences several different phenotypic traits at once, the effect is called pleiotropy.

Step 1 — Example: In phenylketonuria, one mutated gene affects several traits (mental development, skin and hair pigmentation), illustrating pleiotropy.

Step 2 — Contrast: This is the reverse of polygenic inheritance, where many genes affect one trait.

Why other options are wrong:

- Option B: polygenic inheritance is many genes → one trait.
- Option C: codominance describes simultaneous full expression of two alleles.
- Option D: incomplete dominance gives an intermediate phenotype.

Final Answer: One gene affecting many traits is pleiotropy ⇒ **A**

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



Q20.

Solution

Concept — Pedigree analysis: When two unaffected parents produce affected children, the trait must be recessive, and both parents are heterozygous carriers.

Step 1 — Deduce the mode: Unaffected $\times$ unaffected $\rightarrow$ affected child means both parents carry a hidden recessive allele ($Aa \times Aa$).

Step 2 — Autosomal: Since both sons and daughters can be affected, the gene lies on an autosome, so the trait is autosomal recessive.

Why other options are wrong:

- Option A: a dominant trait would show an affected parent in each generation.
- Option C: Y-linked traits pass father to son only and appear in every generation.
- Option D: cytoplasmic (maternal) inheritance does not fit this autosomal pattern.

Final Answer: Carrier parents giving affected children indicate autosomal recessive $\Rightarrow$ **B**

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

Q21.

Solution

Concept — Central dogma: Genetic information flows DNA $\rightarrow$ RNA (transcription) $\rightarrow$ protein (translation). Three RNAs cooperate in translation.

Step 1 — Role of mRNA: Messenger RNA carries the coded message copied from DNA to the ribosome and serves as the template that is read during translation.

Step 2 — Other RNAs: tRNA brings amino acids; rRNA forms part of the ribosome.

Why other options are wrong:

- Option A: tRNA carries amino acids; it is not the ribosome's structure.
- Option B: rRNA is structural/catalytic in the ribosome, not the message carrier.
- Option D: snRNA is involved in splicing, not in synthesising the polypeptide.

Final Answer: mRNA carries the message and is the translation template $\Rightarrow$ **C**



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

Q22.

Solution

Concept — Hershey–Chase experiment: Hershey and Chase used bacteriophages with DNA labelled by ^{32}P and protein coats labelled by ^{35}S to find which molecule enters the bacterium.

Step 1 — Observation: Only the radioactive ^{32}P (in DNA) entered the bacterial cells, while ^{35}S (in protein) stayed outside in the coats.

Step 2 — Conclusion: Therefore DNA, not protein, is the genetic material transferred to the host.

Why other options are wrong:

- Option A: the experiment showed DNA (not protein) is the genetic material.
- Option B: protein coats remained outside; DNA alone entered.
- Option C: the experiment concerned DNA, not RNA.

Final Answer: Labelled DNA (^{32}P) entering the cell shows DNA is the genetic material $\Rightarrow$

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

Q23.

Solution

Concept — Lamarckism: Lamarck proposed that organs used more become better developed (use), unused organs degenerate (disuse), and such acquired characters are inherited.

Step 1 — Apply to the giraffe: Constant stretching to reach high foliage lengthened the neck (use), and this acquired long neck was, he claimed, passed to offspring.

Step 2 — Note: The idea of inheritance of acquired characters was later disproved by Weismann and others.

Why other options are wrong:

- Option B: natural selection on variation is Darwin's explanation, not Lamarck's.



- Option C: large sudden mutations are de Vries' mutation theory.
- Option D: genetic drift is a modern population-genetics concept.

Final Answer: Use and disuse with inheritance of acquired characters $\Rightarrow$ **A**

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

Q24.

Solution

Concept — Filariasis: Filariasis (elephantiasis) is caused by filarial worms of the genus *Wuchereria* (*W. bancrofti* and *W. malayi*).

Step 1 — Transmission: The worms are transmitted to humans through the bite of female mosquitoes that act as vectors.

Step 2 — Effect: They lodge in the lymphatic vessels, causing chronic inflammation and gross swelling of the affected part.

Why other options are wrong:

- Option A: *Ascaris* causes ascariasis, not filariasis.
- Option C: *Plasmodium* causes malaria.
- Option D: *Entamoeba histolytica* causes amoebiasis.

Final Answer: *Wuchereria* worms spread by mosquito bite $\Rightarrow$ **B**

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

Q25.

Solution

Concept — Drug and alcohol abuse: Opioids act on the central nervous system; morphine is a key opioid obtained from the latex of the opium poppy (*Papaver somniferum*).

Step 1 — Morphine: It is a powerful sedative and painkiller, used clinically after surgery, but highly addictive when abused.

Step 2 — Classify others: Cocaine is a stimulant (not an opioid) and cannabinoids act on the brain (heart and cardiovascular system), not mainly the gut.

Why other options are wrong:

- Option A: cannabinoids affect the cardiovascular and nervous systems, not



chiefly digestion.

- Option B: cocaine is a stimulant, not an opioid depressant.
- Option D: long-term heavy drinking damages the liver (cirrhosis).

Final Answer: Morphine is a poppy-derived opioid sedative/painkiller ⇒ **C**

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

Q26.

Solution

Concept — Microbial biocontrol: Biocontrol uses living organisms to manage pests and pathogens instead of chemicals.

Step 1 — *Bacillus thuringiensis*: This soil bacterium produces a protein toxin (Bt toxin) that kills the larvae (caterpillars) of certain insects, and is used as a microbial insecticide.

Step 2 — Confirm: It is the classic microbial biocontrol agent in NCERT.

Why other options are wrong:

- Option B: *Lactobacillus* is used in curd-making, not as an insecticide spray.
- Option C: the ladybird (a beetle) controls aphids; *Penicillium* is a mould (antibiotic source).
- Option D: *Trichoderma* is a fungal biocontrol agent, not a nitrogen-fixing bacterium.

Final Answer: *Bacillus thuringiensis* toxin controls insect caterpillars ⇒ **A**

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

Q27.

Solution

Concept — Steps of rDNA technology: Recombinant DNA technology follows a fixed order of operations to make and express a recombinant product.

Step 1 — Sequence: Isolation of the genetic material (DNA) → cutting at specific sites with restriction enzymes → ligation of the gene into a vector and insertion of recombinant DNA into a host.

Step 2 — Final step: The transformed host is cultured (e.g. in a bioreactor) and the desired product is obtained and purified (downstream processing).



Why other options are wrong:

- Option A: insertion cannot precede isolation and cutting of DNA.
- Option C: obtaining the product cannot be the first step.
- Option D: the product is obtained at the end, not before isolation.

Final Answer: Isolation → cutting → ligation/insertion → product ⇒ B

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

Q28.

Solution

Concept — Transgenic animals: Transgenic animals carry a deliberately introduced foreign gene in their genome, which can be inherited by their offspring.

Step 1 — Uses: They are used to produce useful proteins (for example, human proteins secreted in milk), to study how genes regulate body functions, and to model human diseases for research and drug testing.

Step 2 — Examples: Transgenic mice and cows are common research and production animals.

Why other options are wrong:

- Option A: they are made by gene transfer, not by natural breeding alone.
- Option B: the introduced gene can be passed to the next generation.
- Option C: their main use is research/protein production, not boosting wild populations.

Final Answer: Transgenic cows/mice make useful proteins and model diseases ⇒ D

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



Q29.

Solution

Concept — Population interactions: Interactions are classified by their effect (+, −, 0) on each of the two species involved.

Step 1 — Define commensalism: In commensalism one species benefits (+) while the other is neither harmed nor helped (0), giving a +/0 relationship.

Step 2 — Example: An orchid growing as an epiphyte on a tree branch gains support and light, while the tree is unaffected.

Why other options are wrong:

- Option A: mutualism is +/+ (both benefit).
- Option B: competition is −/− (both harmed).
- Option D: parasitism is +/− (one benefits, the other is harmed).

Final Answer: One benefited, the other unaffected is commensalism (+/0) ⇒ **C**

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

Q30.

Solution

Concept — Biodiversity patterns and loss: Biodiversity is not uniform; it follows the latitudinal gradient and is being lost through human activities.

Step 1 — Latitudinal gradient: Species diversity is highest in the tropics (near the equator) and decreases towards the poles, so tropical rainforests are the richest habitats.

Step 2 — Causes of loss: Habitat loss and fragmentation are the most important causes of biodiversity loss (alongside over-exploitation, alien invasions and co-extinctions).

Why other options are wrong:

- Option A: diversity decreases, not increases, towards the poles.
- Option C: alien species usually threaten, not increase, native biodiversity.
- Option D: tropical rainforests are the most species-rich, not the poorest.

Final Answer: Tropics are richest; habitat loss/fragmentation drives biodiversity loss ⇒ **B**

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



Answer Key

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

