AIIMS Paramedical Biology Sample Paper – 6

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. Arrange the following taxonomic categories in the correct ascending order, starting from the most specific and ending with the most general: family, species, kingdom, genus, order.

(A) Kingdom → order → family → genus → species

(B) Species → genus → family → order → kingdom

(C) Genus → species → family → kingdom → order

(D) Species → family → genus → order → kingdom

Q2. Which of the following correctly describes a herbarium?

(A) A store house of collected, dried, pressed and mounted plant specimens arranged according to an accepted system of classification

(B) A place where living plants are grown for public viewing and recreation

(C) A collection of preserved animal specimens kept in jars of formalin

(D) A catalogue listing only the local names of crop plants

Q3. Which statement about dinoflagellates and euglenoids is correct?

(A) Euglenoids possess a rigid cellulose cell wall like higher plants

(B) Dinoflagellates are always non-photosynthetic decomposers

(C) Dinoflagellates may cause red tides, while euglenoids are photosynthetic in sunlight but heterotrophic in its absence

(D) Both groups are prokaryotic and lack a true nucleus

Q4. In plants showing alternation of generations, the haploid gamete-producing phase and the diploid spore-producing phase are respectively called the

(A) sporophyte and gametophyte

(B) zygote and embryo

(C) antheridium and archegonium

(D) gametophyte and sporophyte

Q5. Which of the following is a defining feature of the phylum Arthropoda, the largest phylum of the animal kingdom?

(A) A segmented body bearing jointed appendages and a chitinous exoskeleton

(B) A soft unsegmented body always enclosed in a calcareous shell

(C) Radial symmetry with stinging cells called cnidoblasts

(D) A water vascular system with tube feet for locomotion

Q6. The mode of arrangement of sepals or petals in a floral bud with respect to the other members of the same whorl is known as

(A) phyllotaxy

(B) venation

(C) aestivation

(D) placentation

Q7. Which statement correctly distinguishes cartilage from bone?

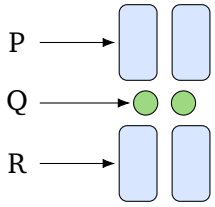
(A) Bone has a soft, pliable matrix while cartilage has a hard, calcified matrix

(B) Cartilage has a solid yet pliable matrix with chondrocytes, whereas bone has a hard matrix hardened by calcium salts and contains osteocytes

(C) Both cartilage and bone completely lack living cells in their matrix

(D) Cartilage cells are called osteoblasts and bone cells are called chondrocytes

Q8. The diagram shows a metaphase chromosome with its parts labelled P, Q and R.



P, Q and R respectively represent the

(A) telomere, kinetochore and centrosome

(B) satellite, spindle fibre and chromomere

(C) nucleolus, ribosome and nuclear pore

(D) chromatid (arm), centromere and chromatid (arm)

Q9. Which of the following statements about carbohydrates and lipids is correct?

(A) Glycogen is the storage polysaccharide of animals, while triglycerides (fats) store more energy per gram than carbohydrates

(B) Cellulose is the chief storage carbohydrate of the human liver

(C) Lipids are polymers of amino acids joined by peptide bonds

(D) Starch is a lipid found mainly in animal adipose tissue

Q10. Which statement correctly distinguishes active transport from simple diffusion across a cell membrane?

(A) Active transport always moves substances down a concentration gradient without energy

(B) Simple diffusion requires ATP and carrier proteins, while active transport does not

(C) Active transport moves substances against a concentration gradient using metabolic energy (ATP), whereas simple diffusion is passive and needs no energy

(D) Both processes require ATP and a membrane pump in every case

Q11. According to the chemiosmotic hypothesis, ATP synthesis during the light reaction of photosynthesis is driven by

(A) the breakdown of glucose in the stroma

(B) a proton (H^+) gradient across the thylakoid membrane that drives protons through ATP synthase

(C) direct absorption of light by ATP synthase

(D) fixation of carbon dioxide in the Calvin cycle

Q12. Which pairing of a plant growth regulator with its characteristic effect is correct?

(A) Cytokinins — promote senescence and leaf abscission

(B) Gibberellins — induce dormancy and inhibit seed germination

(C) Abscisic acid — promotes bolting in rosette plants

(D) Gibberellins — promote stem elongation and bolting; cytokinins — promote cell division and delay leaf senescence

Q13. The vital capacity of the lungs is best defined as

(A) the maximum volume of air a person can breathe out after a forced maximum inspiration (ERV + TV + IRV)

(B) the volume of air that always remains in the lungs even after the most forceful expiration

(C) the volume of air inspired or expired during a single normal breath

(D) the total volume of air the lungs can hold including the residual volume

Q14. During haemodialysis used to treat kidney failure, the wastes are removed from the patient's blood mainly by

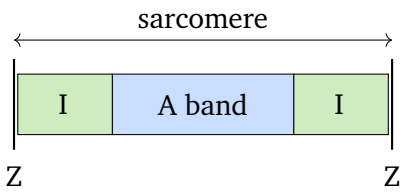
(A) active pumping of urea into the dialysing fluid by ATP-driven pumps

(B) filtration under high pressure exactly as in a normal glomerulus

(C) diffusion of nitrogenous wastes from the blood across a semipermeable membrane into the dialysing fluid, which lacks these wastes

(D) complete replacement of the patient's blood with fresh donor blood

Q15. The figure shows a sarcomere, the functional unit of a myofibril, with its regions labelled.



Which statement about the sarcomere is correct?

(A) The sarcomere lies between two consecutive A bands

(B) A sarcomere is the region between two successive Z lines; it contains a central A band (thick myosin filaments) flanked by half I bands (thin actin filaments)

(C) The A band contains only thin actin filaments

(D) During contraction the actual length of the A band increases greatly

Q16. Apomixis in flowering plants is best described as

(A) the fusion of two male gametes with a single egg

(B) the formation of multiple flowers from one bud

(C) normal fertilisation followed by double fertilisation

(D) the production of seeds without fertilisation, giving offspring genetically identical to the mother plant

Q17. In human reproduction, fertilisation and implantation respectively normally occur in the

(A) ampulla of the fallopian tube, and the wall of the uterus

(B) uterus, and the ovary

(C) vagina, and the cervix

(D) ovary, and the fallopian tube

Q18. Intra-uterine devices (IUDs) such as the copper-T act as contraceptives mainly by

(A) permanently blocking the vas deferens

(B) supplying large doses of oestrogen and progesterone orally

(C) increasing phagocytosis of sperms in the uterus and, for copper-releasing types, suppressing sperm motility and the fertilising capacity of sperms

(D) surgically removing a segment of the fallopian tube

Q19. Human skin colour and human height are classic examples of polygenic inheritance. A key feature of polygenic inheritance is that

(A) a single gene with two alleles controls the trait completely

(B) the trait is governed by three or more genes, and the phenotype shows continuous variation that is also influenced by the environment

(C) the heterozygote shows a phenotype intermediate between the two homozygotes only

(D) the trait is always determined by genes located on the Y chromosome

Q20. Match each chromosomal disorder with its correct karyotype.

(A) Down's syndrome — 45, X (monosomy of X)

(B) Turner's syndrome — 47, XXY

(C) Klinefelter's syndrome — trisomy of chromosome 21

(D) Down's syndrome — trisomy 21; Turner's syndrome — 45, X; Klinefelter's syndrome — 47, XXY

Q21. In Griffith's experiment, mice died when injected with a mixture of heat-killed virulent (S) bacteria and living non-virulent (R) bacteria. This result demonstrated that

(A) some 'transforming principle' passed from the dead S strain into the living R strain, making it virulent

(B) heat-killed bacteria can be revived directly by warmth in the mouse body

(C) the R strain was virulent on its own all along

(D) proteins from the R strain killed the mice

Q22. Which of the following statements about the Human Genome Project (HGP) is correct?

(A) It was completed in a single day by one laboratory

(B) It showed that humans have more than two million protein-coding genes

(C) It aimed to sequence all the bases in the human genome and found roughly 3 billion base pairs and far fewer genes than expected (around 20,000–25,000)

(D) It proved that the entire genome codes for proteins, with no non-coding DNA

Q23. Darwin's finches of the Galapagos Islands, which evolved different beak types from a common ancestor to exploit different food sources, are a classic example of

(A) convergent evolution of unrelated species

(B) adaptive radiation, the evolution of diverse forms from a common ancestor in different habitats

(C) genetic drift in a large stable population

(D) the inheritance of acquired characters

Q24. Which of the following statements about cancers is correct?

(A) All tumours are malignant and always spread (metastasise) to distant organs

(B) Sarcomas arise from epithelial tissues, while carcinomas arise from connective tissues

(C) Cancer cells always retain the property of contact inhibition

(D) Cancer results from the loss of regulation over cell division; carcinomas arise from epithelial cells and sarcomas from connective tissue, and physical, chemical or biological carcinogens can cause it

Q25. Which statement correctly distinguishes an allergy from an autoimmune disease?

(A) An allergy is an exaggerated immune response to an environmental allergen (with release of histamine), whereas in an autoimmune disease the immune system attacks the body's own cells, as in rheumatoid arthritis

(B) In an allergy the body attacks its own tissues, while an autoimmune disease is caused by pollen

(C) Both allergy and autoimmune disease are caused by a lack of any immune response

(D) Allergies are always caused by the body producing too few antibodies

Q26. Which of the following correctly describes a biofertilizer and its action?

(A) *Rhizobium* is a free-living fungus that decomposes dead leaves in the soil

(B) Mycorrhiza is a bacterium that converts atmospheric nitrogen into nitrates in root nodules

(C) *Rhizobium* fixes atmospheric nitrogen in the root nodules of legumes, while mycorrhiza (a fungus–root association) helps the plant absorb phosphorus

(D) Both *Rhizobium* and mycorrhiza are harmful pathogens that destroy crop roots

Q27. The Bt toxin used to make crops such as Bt cotton insect-resistant is

(A) a ready-made active poison that kills the bacterium *Bacillus thuringiensis* itself

(B) coded by *cry* genes and produced as an inactive protein crystal that becomes active in the alkaline gut of the insect, where it lyses the gut cells

(C) a herbicide that kills weeds growing near the crop

(D) an antibiotic that protects the plant from fungal infection

Q28. Which statement about molecular diagnostic techniques is correct?

(A) ELISA can detect a pathogen only after the disease symptoms have fully developed

(B) PCR destroys the DNA of the pathogen so it can no longer be detected

(C) ELISA detects DNA directly, whereas PCR detects antigens or antibodies

(D) PCR can detect very low amounts of a pathogen by amplifying its nucleic acid, while ELISA detects antigens or antibodies produced against the pathogen

Q29. The energy-flow diagram shows the flow of energy through trophic levels of an ecosystem.

This pattern, in which only about 10% of the energy is transferred from one trophic level to the next, illustrates

(A) Lindeman's ten percent law of energy transfer in an ecosystem

(B) the law of independent assortment

(C) the Hardy–Weinberg equilibrium

(D) the principle of competitive exclusion

Q30. Which of the following is an example of ex situ conservation of biodiversity?

(A) Declaring a national park to protect tigers in their natural habitat

(B) Setting up a biosphere reserve around a tropical forest

(C) Maintaining threatened species in zoological parks, botanical gardens and seed banks away from their natural habitat

(D) Creating a wildlife sanctuary for migratory birds in a wetland

Detailed Solutions

Q1.

Solution

Concept — Taxonomic hierarchy: Living organisms are classified into a ranked series of categories. From the most specific to the most general the order is species → genus → family → order → class → phylum → kingdom.

Step 1 — Identify the smallest unit: The species is the basic and most specific category, grouping very similar individuals.

Step 2 — Build upwards: Related species are grouped into a genus, related genera into a family, related families into an order, and so on up to the kingdom.

Step 3 — Match with the options: Among the five given categories the correct ascending sequence is species → genus → family → order → kingdom.

Why other options are wrong:

- Option (A): this is the descending order (kingdom first), not ascending.
- Option (C): genus does not come before species, and order is misplaced.
- Option (D): family is wrongly placed before genus.

Final Answer: Species → genus → family → order → kingdom ⇒ B

Answer: (B) Go Back to Q1

Q2.

Solution

Concept — Taxonomic aids: Herbaria, botanical gardens, zoological parks, museums and keys are tools that help in the identification and study of organisms.

Step 1 — Define a herbarium: A herbarium is a store house of collected plant specimens that are dried, pressed and mounted on sheets.

Step 2 — Arrangement: The mounted specimens are arranged according to a universally accepted system of classification, and each sheet carries a label with details of the plant.

Why other options are wrong:

- Option (B): this describes a botanical garden, where living plants are grown.
- Option (C): preserved animal specimens belong to a museum, not a herbarium.

- Option (D): a list of local names is not a herbarium.

Final Answer: A store of dried, pressed and mounted plant specimens $\Rightarrow$ A

Answer: (A) Go Back to Q2

Q3.

Solution

Concept — Protista (dinoflagellates and euglenoids): These are eukaryotic, mostly aquatic protists with varied modes of nutrition.

Step 1 — Dinoflagellates: They are mostly marine and photosynthetic; their rapid multiplication can colour the sea red, causing red tides, and some release toxins.

Step 2 — Euglenoids: They lack a cell wall and instead have a protein-rich pellicle. They are photosynthetic in sunlight but behave as heterotrophs (predators) when deprived of light.

Why other options are wrong:

- Option (A): euglenoids have a pellicle, not a rigid cellulose wall.
- Option (B): dinoflagellates are largely photosynthetic, not decomposers.
- Option (D): both groups are eukaryotic with a true nucleus.

Final Answer: Dinoflagellates cause red tides; euglenoids switch between autotrophy and heterotrophy $\Rightarrow$ C

Answer: (C) Go Back to Q3

Q4.

Solution

Concept — Alternation of generations: The life cycle of land plants alternates between a haploid gametophyte and a diploid sporophyte.

Step 1 — Gametophyte: The haploid (n) phase produces gametes by mitosis; it is the gamete-producing phase.

Step 2 — Sporophyte: Fusion of gametes gives a diploid (2n) zygote that grows into the sporophyte, which produces haploid spores by meiosis; it is the spore-producing phase.

Why other options are wrong:

- Option (A): the order of the two phases is reversed.
- Option (B): zygote and embryo are stages, not the two alternating generations.
- Option (C): antheridium and archegonium are sex organs, not generations.

Final Answer: Gamete-producing = gametophyte; spore-producing = sporophyte $\Rightarrow$ D

Answer: (D) Go Back to Q4

Q5.

Solution

Concept — Phylum Arthropoda: Arthropods are the largest group of animals, including insects, crustaceans, arachnids and myriapods.

Step 1 — Key features: Their body is segmented and bears jointed appendages (the name means 'jointed legs').

Step 2 — Body covering: They have a hard chitinous exoskeleton, an open circulatory system, and bilateral symmetry.

Why other options are wrong:

- Option (B): a calcareous shell over a soft body describes Mollusca.
- Option (C): radial symmetry with cnidoblasts describes Coelenterata.
- Option (D): a water vascular system with tube feet describes Echinodermata.

Final Answer: Segmented body, jointed appendages, chitinous exoskeleton $\Rightarrow$ A

Answer: (A) Go Back to Q5

Q6.

Solution

Concept — Floral terms: Several technical terms describe how floral parts are arranged.

Step 1 — Define aestivation: Aestivation is the mode of arrangement of sepals or petals in the floral bud relative to other members of the same whorl (for example valvate, twisted, imbricate, vexillary).

Step 2 — Eliminate look-alikes: Phyllotaxy is the arrangement of leaves on a stem; venation is the pattern of veins in a leaf; placentation is the arrangement of

ovules in the ovary.

Why other options are wrong:

- Options (A), (B) and (D) refer to leaves, veins and ovules, not to sepals or petals in a bud.

Final Answer: Arrangement of sepals/petals in a bud is aestivation $\Rightarrow$ C

Answer: (C) Go Back to Q6

Q7.

Solution

Concept — Skeletal connective tissues: Cartilage and bone are specialised connective tissues that support the body.

Step 1 — Cartilage: Its matrix (chondrin) is solid yet pliable and resists compression; the cells are chondrocytes lying in spaces called lacunae.

Step 2 — Bone: Its matrix is hard and non-pliable because it is rich in calcium salts; the cells are osteocytes, and bone provides a rigid framework.

Why other options are wrong:

- Option (A): the descriptions of the two matrices are swapped.
- Option (C): both tissues contain living cells in their matrix.
- Option (D): the cell names are interchanged.

Final Answer: Cartilage = pliable matrix with chondrocytes; bone = hard calcified matrix with osteocytes $\Rightarrow$ B

Answer: (B) Go Back to Q7

Q8.

Solution

Concept — Chromosome structure: A metaphase chromosome consists of two identical sister chromatids held together at a constricted point.

Step 1 — Read the diagram: P and R are the long thread-like arms (the two sister chromatids), while Q is the central constriction joining them.

Step 2 — Name the parts: The central constriction Q is the centromere, which carries the kinetochore for spindle attachment; P and R are the chromatids (arms).

Why other options are wrong:

- Option (A): a telomere is only the tip; a centrosome is outside the chromosome.
- Option (B): a satellite is a small body on certain chromosomes, not the whole arm.
- Option (C): nucleolus, ribosome and nuclear pore are not parts of a chromosome.

Final Answer: P = chromatid arm, Q = centromere, R = chromatid arm $\Rightarrow$ D

Answer: (D) Go Back to Q8

Q9.

Solution

Concept — Carbohydrates and lipids: Both are energy-related biomolecules but differ in structure and storage.

Step 1 — Storage forms: Glycogen is the storage polysaccharide of animals (stored in liver and muscle); starch is the storage form in plants.

Step 2 — Energy content: Fats (triglycerides) yield about 9 kcal per gram, more than twice the energy from a gram of carbohydrate, making them efficient long-term energy stores.

Why other options are wrong:

- Option (B): the human liver stores glycogen, not cellulose.
- Option (C): lipids are not polymers of amino acids; proteins are.
- Option (D): starch is a carbohydrate of plants, not a lipid of animals.

Final Answer: Glycogen is the animal storage carbohydrate and fats store more energy per gram $\Rightarrow$ A

Answer: (A) Go Back to Q9

Q10.

Solution

Concept — Membrane transport: Substances cross membranes by passive processes (diffusion, osmosis, facilitated diffusion) or by active transport.

Step 1 — Simple diffusion: It is passive, moves substances down (high to low) their concentration gradient, and needs no metabolic energy.

Step 2 — Active transport: It moves substances against the gradient (low to high) using carrier proteins (pumps) and energy from ATP.

Why other options are wrong:

- Option (A): active transport moves substances against the gradient and needs energy.
- Option (B): the descriptions of the two processes are swapped.
- Option (D): simple diffusion needs no ATP or pump.

Final Answer: Active transport is uphill and ATP-driven; diffusion is passive $\Rightarrow$ C

Answer: (C) Go Back to Q10

Q11.

Solution

Concept — Chemiosmotic hypothesis: Proposed by Peter Mitchell, it explains ATP synthesis using a proton gradient across a membrane.

Step 1 — Build the gradient: During the light reaction, electron transport and the splitting of water release protons into the thylakoid lumen, creating a high H^+ concentration there.

Step 2 — Drive ATP synthase: Protons flow back into the stroma through the F_0–F_1 ATP synthase enzyme, and this flow drives the synthesis of ATP from ADP and inorganic phosphate.

Why other options are wrong:

- Option (A): glucose breakdown is not part of the light reaction.
- Option (C): ATP synthase does not absorb light directly.
- Option (D): carbon fixation is the dark reaction and does not make ATP.

Final Answer: A proton gradient across the thylakoid drives ATP synthase $\Rightarrow$ B

Answer: (B) Go Back to Q11

Q12.

Solution

Concept — Plant growth regulators: Auxins, gibberellins, cytokinins, ethylene and abscisic acid each have characteristic actions.

Step 1 — Gibberellins: They promote stem and internode elongation and cause bolting (rapid elongation of the stem before flowering) in rosette plants.

Step 2 — Cytokinins: They promote cell division (cytokinesis) and delay the ageing (senescence) of leaves, keeping them green longer.

Why other options are wrong:

- Option (A): cytokinins delay senescence, they do not promote it.
- Option (B): gibberellins break dormancy and promote germination.
- Option (C): abscisic acid promotes dormancy, not bolting.

Final Answer: Gibberellins cause bolting; cytokinins promote cell division and delay senescence $\Rightarrow$ D

Answer: (D) Go Back to Q12

Q13.

Solution

Concept — Respiratory volumes and capacities: Lung capacities are sums of two or more respiratory volumes.

Step 1 — Define vital capacity: Vital capacity (VC) is the maximum volume of air a person can breathe out after a forced maximum inspiration. It equals ERV + TV + IRV.

Step 2 — Contrast with others: Residual volume is the air left after forceful expiration; tidal volume is the air per normal breath; total lung capacity includes the residual volume as well.

Why other options are wrong:

- Option (B): this defines residual volume.
- Option (C): this defines tidal volume.
- Option (D): this defines total lung capacity, not vital capacity.

Final Answer: Maximum expiration after maximum inspiration (ERV+TV+IRV) $\Rightarrow$ A

Answer: (A) Go Back to Q13

Q14.

Solution

Concept — Haemodialysis: In kidney failure, urea and other nitrogenous wastes accumulate in the blood and must be removed by an artificial kidney.

Step 1 — Set-up: The patient's blood is passed through a coiled tube made of a semipermeable membrane that is surrounded by a dialysing fluid.

Step 2 — Removal of wastes: The dialysing fluid has the same composition as plasma except that it has no nitrogenous wastes, so urea and other wastes diffuse out of the blood across the membrane into the fluid.

Why other options are wrong:

- Option (A): removal is by passive diffusion, not active pumping.
- Option (B): there is no glomerular pressure filtration in dialysis.
- Option (D): blood is cleaned and returned, not fully replaced.

Final Answer: Wastes diffuse from blood into the waste-free dialysing fluid $\Rightarrow$ C

Answer: (C) Go Back to Q14

Q15.

Solution

Concept — Sarcomere: The sarcomere is the functional contractile unit of a striated muscle myofibril.

Step 1 — Boundaries: A sarcomere is the region between two successive Z lines (Z discs).

Step 2 — Internal bands: It contains a central dark A band of thick myosin filaments, flanked on either side by light I bands of thin actin filaments. During contraction the actin filaments slide over the myosin, so the I band shortens while the A band length stays the same.

Why other options are wrong:

- Option (A): the sarcomere lies between Z lines, not between A bands.
- Option (C): the A band contains thick myosin filaments.
- Option (D): the A band length does not increase; the I band shortens.

Final Answer: Sarcomere = region between two Z lines, with a central A band and flanking I bands $\Rightarrow$ B

Answer: (B) Go Back to Q15

Q16.

Solution

Concept — Apomixis: Apomixis is a form of asexual reproduction that mimics sexual reproduction in seed plants.

Step 1 — Definition: It is the formation of seeds without fertilisation. The embryo develops from a diploid cell of the ovule, not from a fertilised egg.

Step 2 — Consequence: Because no fusion of gametes is involved, the seeds give rise to offspring that are genetically identical to the mother plant, which is useful for preserving hybrid vigour.

Why other options are wrong:

- Option (A): fusion of two male gametes with an egg is not apomixis.
- Option (B): formation of many flowers from one bud is not apomixis.
- Option (C): apomixis bypasses fertilisation, including double fertilisation.

Final Answer: Seeds formed without fertilisation, giving clones of the mother $\Rightarrow$ D

Answer: (D) Go Back to Q16

Q17.

Solution

Concept — Fertilisation and implantation: These two events occur at different sites in the female reproductive tract.

Step 1 — Fertilisation: The sperm fuses with the ovum in the ampullary region (ampulla) of the fallopian tube, forming a zygote.

Step 2 — Implantation: The zygote divides to form a blastocyst, which travels to the uterus and gets embedded (implanted) in the endometrial wall of the uterus.

Why other options are wrong:

- Option (B): fertilisation does not occur in the uterus, nor implantation in the ovary.

- Option (C): neither event normally occurs in the vagina or cervix.
- Option (D): the two sites are reversed.

Final Answer: Fertilisation in the ampulla of the fallopian tube; implantation in the uterine wall $\Rightarrow$ A

Answer: (A) Go Back to Q17

Q18.

Solution

Concept — Intra-uterine devices: IUDs such as the copper-T, Multiload-375 and LNG-20 are inserted into the uterus to prevent pregnancy.

Step 1 — General action: IUDs increase the phagocytosis of sperms within the uterus, making the uterine environment hostile to sperms.

Step 2 — Copper-releasing IUDs: The copper ions released suppress sperm motility and reduce the fertilising capacity of the sperms, while hormone-releasing IUDs also make the cervical mucus hostile.

Why other options are wrong:

- Option (A): blocking the vas deferens is vasectomy.
- Option (B): oral hormones describe the contraceptive pill.
- Option (D): cutting the fallopian tube is tubectomy.

Final Answer: IUDs increase sperm phagocytosis and (copper types) suppress sperm motility $\Rightarrow$ C

Answer: (C) Go Back to Q18

Q19.

Solution

Concept — Polygenic inheritance: Some traits are controlled by more than one gene, each adding to the phenotype.

Step 1 — Definition: In polygenic inheritance a trait is governed by three or more genes (each with additive effect), so the phenotype shows a graded, continuous variation rather than distinct classes.

Step 2 — Environmental effect: The expression of such traits, like human skin colour and height, is also influenced by environmental factors such as sunlight and

nutrition.

Why other options are wrong:

- Option (A): a single gene gives discrete classes, not continuous variation.
- Option (C): an intermediate heterozygote describes incomplete dominance.
- Option (D): polygenes are not restricted to the Y chromosome.

Final Answer: Several additive genes give continuous, environment-influenced variation $\Rightarrow$ B

Answer: (B) Go Back to Q19

Q20.

Solution

Concept — Chromosomal disorders: These arise from aneuploidy (gain or loss of a chromosome).

Step 1 — Down's syndrome: Caused by an extra copy of chromosome 21 (trisomy 21), giving 47 chromosomes.

Step 2 — Turner's and Klinefelter's: Turner's syndrome is 45, X (a single X, monosomy) in females; Klinefelter's syndrome is 47, XXY (an extra X) in males.

Why other options are wrong:

- Options (A), (B) and (C) each mismatch a disorder with the wrong karyotype.

Final Answer: Down's = trisomy 21; Turner's = 45,X; Klinefelter's = 47,XXY $\Rightarrow$ D

Answer: (D) Go Back to Q20

Q21.

Solution

Concept — Griffith's transformation experiment: Frederick Griffith (1928) worked with two strains of *Streptococcus pneumoniae*: the virulent smooth (S) strain and the non-virulent rough (R) strain.

Step 1 — The observation: Mice given a mixture of heat-killed S bacteria and living R bacteria died, and living S bacteria were recovered from them.

Step 2 — The conclusion: Some 'transforming principle' had passed from the dead S cells into the living R cells, converting them into the virulent S form. This principle was later shown by Avery, MacLeod and McCarty to be DNA.

Why other options are wrong:

- Option (B): heat-killed bacteria were not revived by warmth.
- Option (C): the R strain alone was harmless.
- Option (D): the transforming material was DNA, not R-strain protein.

Final Answer: A transforming principle passed from dead S to living R bacteria $\Rightarrow$ A

Answer: (A) Go Back to Q21

Q22.

Solution

Concept — Human Genome Project: The HGP (1990–2003) was an international effort to sequence the entire human genome.

Step 1 — The goal: It aimed to determine the sequence of all the bases (about 3 billion base pairs) in human DNA and to identify all the genes.

Step 2 — A key finding: Humans have far fewer genes than expected, only about 20,000 to 25,000, and a large part of the genome is non-coding DNA.

Why other options are wrong:

- Option (A): the project took over a decade and many laboratories.
- Option (B): the gene number is around 25,000, not millions.
- Option (D): much of the genome is non-coding, not protein-coding.

Final Answer: HGP sequenced about 3 billion base pairs and found roughly 20,000–25,000 genes $\Rightarrow$ C

Answer: (C) Go Back to Q22

Q23.

Solution

Concept — Adaptive radiation: This is the evolution of many different forms from a single ancestral species, each adapted to a different niche.

Step 1 — Darwin's finches: On the Galapagos Islands, an ancestral seed-eating finch gave rise to many varieties with different beak shapes suited to different diets (seeds, insects and so on).

Step 2 — Identify the term: This diversification of a common ancestor into many forms in different habitats is adaptive radiation (another example is Australian marsupials).

Why other options are wrong:

- Option (A): convergent evolution is when unrelated species become similar.
- Option (C): genetic drift acts strongly in small, not large, populations.
- Option (D): inheritance of acquired characters is Lamarck's discarded idea.

Final Answer: Diverse beak forms from a common ancestor = adaptive radiation $\Rightarrow \boxed{B}$

Answer: (B) Go Back to Q23

Q24.

Solution

Concept — Cancer: Cancer is the uncontrolled division of cells, which lose contact inhibition and may spread.

Step 1 — Types by origin: Carcinomas arise from epithelial cells (e.g. skin, breast, lung), while sarcomas arise from connective and other mesodermal tissues (e.g. bone, cartilage).

Step 2 — Causes: Carcinogens may be physical (ionising radiation, UV), chemical (tobacco smoke) or biological (oncogenic viruses), all of which can transform normal cells into cancer cells.

Why other options are wrong:

- Option (A): benign tumours stay in place and do not metastasise.
- Option (B): the origins of sarcoma and carcinoma are swapped.
- Option (C): cancer cells lose contact inhibition.

Final Answer: Loss of division control; carcinomas from epithelium, sarcomas

from connective tissue, with varied carcinogens $\Rightarrow$ D

Answer: (D) Go Back to Q24

Q25.

Solution

Concept — Allergy vs autoimmunity: Both are disorders of the immune system but differ in their target.

Step 1 — Allergy: An allergy is an exaggerated (hypersensitive) response of the immune system to certain harmless environmental substances (allergens) such as pollen or dust mites, releasing histamine and causing sneezing, watery eyes and so on.

Step 2 — Autoimmune disease: Here the immune system fails to recognise self and attacks the body's own cells and tissues, as in rheumatoid arthritis.

Why other options are wrong:

- Option (B): the definitions of the two conditions are swapped.
- Option (C): both involve immune responses, not their absence.
- Option (D): allergies involve excess response, not too few antibodies.

Final Answer: Allergy = overreaction to an allergen; autoimmunity = attack on self $\Rightarrow$ A

Answer: (A) Go Back to Q25

Q26.

Solution

Concept — Biofertilizers: These are living organisms that enrich the nutrient quality of the soil.

Step 1 — *Rhizobium*: It is a bacterium that lives symbiotically in the root nodules of leguminous plants and fixes atmospheric nitrogen into a form the plant can use.

Step 2 — Mycorrhiza: It is a symbiotic association between a fungus and plant roots; the fungal partner greatly increases the absorption of phosphorus and other nutrients from the soil.

Why other options are wrong:

- Option (A): *Rhizobium* is a symbiotic nitrogen-fixing bacterium, not a de-

composing fungus.

- Option (B): the descriptions of *Rhizobium* and mycorrhiza are swapped.
- Option (D): both are beneficial, not pathogenic.

Final Answer: *Rhizobium* fixes nitrogen in legume nodules; mycorrhiza aids phosphorus uptake $\Rightarrow$ C

Answer: (C) Go Back to Q26

Q27.

Solution

Concept — Bt toxin: *Bacillus thuringiensis* produces an insecticidal protein, the *cry* (Bt) toxin.

Step 1 — Inactive form: The toxin is produced as inactive protein crystals (protoxin) and does not harm the bacterium itself.

Step 2 — Activation in the insect: When an insect eats it, the alkaline pH of the insect gut solubilises the crystal and activates the toxin, which binds to the gut epithelium, creates pores and lyses the cells, killing the insect.

Why other options are wrong:

- Option (A): the toxin does not kill the producing bacterium.
- Option (C): Bt toxin is an insecticide, not a herbicide.
- Option (D): it is not an antifungal antibiotic.

Final Answer: *cry*-gene protein, made as an inactive crystal, is activated in the alkaline insect gut $\Rightarrow$ B

Answer: (B) Go Back to Q27

Q28.

Solution

Concept — Molecular diagnosis: Early and accurate detection of disease uses techniques such as PCR and ELISA.

Step 1 — PCR: The polymerase chain reaction amplifies the nucleic acid of a pathogen, so even very low amounts of the pathogen (before symptoms appear) can be detected.

Step 2 — ELISA: The enzyme-linked immunosorbent assay detects either antigens

of the pathogen or the antibodies produced by the body against it.

Why other options are wrong:

- Option (A): ELISA and PCR allow early detection, not only after symptoms.
- Option (B): PCR amplifies, it does not destroy, the pathogen's DNA.
- Option (C): the roles of ELISA and PCR are swapped.

Final Answer: PCR amplifies pathogen nucleic acid; ELISA detects antigens or antibodies $\Rightarrow$ D

Answer: (D) Go Back to Q28

Q29.

Solution

Concept — Energy flow in an ecosystem: Energy enters as sunlight, is fixed by producers and flows in one direction through the trophic levels.

Step 1 — Read the diagram: The producers hold 1000 J, the herbivores only 100 J, and the carnivores only 10 J, so about one tenth of the energy passes to each next level.

Step 2 — Identify the law: This is the ten percent law given by Lindeman: only about 10% of the energy at one trophic level is available to the next level, the rest being lost mainly as heat.

Why other options are wrong:

- Option (B): independent assortment is a law of genetics.
- Option (C): Hardy–Weinberg concerns allele frequencies, not energy.
- Option (D): competitive exclusion concerns two species sharing a niche.

Final Answer: Only $\sim$10% energy transfers per level = Lindeman's ten percent law $\Rightarrow$ A

Answer: (A) Go Back to Q29

Q30.

Solution

Concept — Conservation of biodiversity: Conservation may be in situ (on site) or ex situ (off site).

Step 1 — In situ: Protecting species in their natural habitat, as in national parks, wildlife sanctuaries and biosphere reserves, is in situ conservation.

Step 2 — Ex situ: Conserving threatened species outside their natural habitat, in zoological parks, botanical gardens, seed banks and gene banks, is ex situ conservation.

Why other options are wrong:

- Options (A), (B) and (D) all describe protection within the natural habitat, which is in situ conservation.

Final Answer: Keeping species in zoos, botanical gardens and seed banks is ex situ conservation $\Rightarrow$ C

Answer: (C) Go Back to Q30

Answer Key

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