

JCECE Biology Sample Paper – 4

Duration: 60 Minutes

Maximum Marks: 50

Instructions

- This paper contains **50** Multiple Choice Questions (Single Correct Answer), modelled on the Biology portion of JCECE entrance.
- Each correct answer carries **+1 mark**. There is **-0.25 mark** for each incorrect answer; unattempted questions get 0.
- Only **one** option is correct. Choose carefully.
- Syllabus level: **Class 11 and Class 12 NCERT Biology (Jharkhand JAC / CBSE aligned) – Botany and Zoology.**
- Use of mobile phones, calculators, or electronic gadgets is strictly prohibited.

Q1. Members of the kingdom Fungi (except a few) are non-green and obtain their nourishment by absorbing dissolved organic matter from dead or living material. With respect to their mode of nutrition, fungi are best described as:

- (A) photoautotrophic, fixing carbon by photosynthesis
- (B) heterotrophic by absorption (saprophytic or parasitic)
- (C) chemoautotrophic, oxidising inorganic substances
- (D) holozoic, ingesting solid food particles

Q2. A herbarium is an important taxonomic aid maintained by botanists. A herbarium is best defined as a:

- (A) store house of collected, dried, pressed and labelled plant specimens on sheets
- (B) garden where living plants are grown for reference and study
- (C) book that gives the correct scientific names of plants



(D) collection of preserved animals in jars of formalin

Q3. Gymnosperms (such as *Cycas* and *Pinus*) are seed-bearing plants that differ from angiosperms in one fundamental feature of their ovules. In gymnosperms the ovules (and hence the seeds) are:

(A) enclosed within a ripened ovary that forms a fruit

(B) produced inside closed carpels with a stigma

(C) formed only after double fertilization

(D) naked, i.e. not enclosed within an ovary wall

Q4. The phylum Aschelminthes (e.g. *Ascaris*, *Wuchereria*) shows a major advance over the flatworms in the organisation of its body cavity. The roundworms possess a body cavity that is:

(A) completely absent (they are acoelomate)

(B) a true coelom fully lined by mesoderm

(C) a pseudocoelom (a false coelom not lined by mesoderm)

(D) a haemocoel filled with blood

Q5. Phloem conducts food in plants. Among its components, the conducting cells that are enucleate at maturity yet remain alive, and depend on adjacent companion cells for their functioning, are the:

(A) sieve tube elements

(B) tracheids of the xylem

(C) vessel elements of the xylem

(D) phloem fibres (bast fibres)

Q6. Nervous tissue is specialised for the reception and rapid conduction of stimuli. The structural and functional unit of nervous tissue, which actually conducts the nerve impulse, is the:

(A) neuroglia (glial cell)



- (B) Schwann cell
- (C) neuron (nerve cell)
- (D) ependymal cell

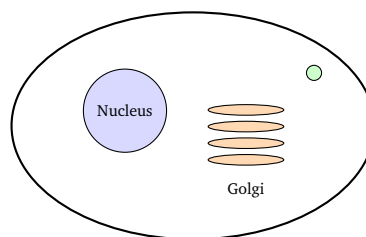
Q7. In an inflorescence the main axis goes on growing and bears flowers laterally in an acropetal succession (older flowers towards the base, younger towards the tip). This type of inflorescence is called:

- (A) cymose, with the main axis ending in a flower
- (B) racemose, with the main axis continuing to grow
- (C) a solitary terminal flower
- (D) a special type such as cyathium

Q8. The earthworm (*Pheretima*) moves through the soil by alternate contraction of its body-wall muscles, aided by tiny S-shaped chitinous structures that grip the substratum. These locomotory structures are the:

- (A) parapodia
- (B) tube feet
- (C) jointed walking legs
- (D) setae (chaetae) embedded in the segments

Q9. In the cell shown below, the stacked, flattened, membrane-bound sacs (cisternae) marked carry out packaging and dispatch of cell products. The principal function of this Golgi apparatus is to:



- (A) process, package and secrete materials, and form lysosomes
- (B) synthesise ATP by aerobic respiration



- (C) store the genetic material of the cell
- (D) carry out photosynthesis to make sugars

Q10. Some polar or charged molecules cross the plasma membrane down their concentration gradient with the help of specific carrier or channel proteins, but *without* spending ATP. This mode of transport is called:

- (A) active transport against the gradient
- (B) facilitated diffusion
- (C) endocytosis (engulfing of particles)
- (D) simple diffusion through the lipid bilayer

Q11. Nucleic acids (DNA and RNA) are polymers of nucleotides. A single nucleotide is built from three chemically distinct components, namely:

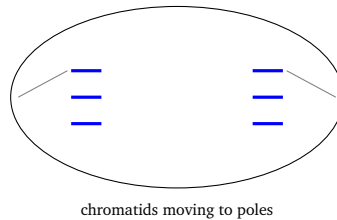
- (A) three fatty acids joined to a glycerol
- (B) an amino group, a carboxyl group and an R-group
- (C) a nitrogenous base, a pentose sugar and a phosphate group
- (D) only a nitrogenous base joined to a phosphate

Q12. Enzyme activity is sensitive to temperature. As temperature is raised much above the optimum, the rate of an enzyme-catalysed reaction falls sharply mainly because the enzyme:

- (A) is converted into its substrate
- (B) permanently increases its activity with no upper limit
- (C) changes into a coenzyme
- (D) is denatured, as its three-dimensional structure is destroyed

Q13. The figure shows sister chromatids being pulled apart towards opposite poles of the cell by shortening spindle fibres. This event is characteristic of mitotic *anaphase*, in which:



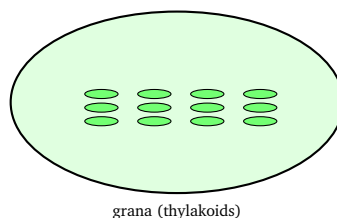


- (A) the centromeres split and the sister chromatids move to opposite poles as daughter chromosomes
- (B) the chromatin condenses and the nuclear envelope breaks down
- (C) the chromosomes line up exactly on the equatorial metaphase plate
- (D) two daughter nuclei reorganise and the cytoplasm divides

Q14. Meiosis is essential for sexually reproducing organisms. The most important biological significance of meiosis is that it:

- (A) doubles the chromosome number in each generation
- (B) halves the chromosome number and generates genetic variation through recombination
- (C) produces two genetically identical diploid daughter cells
- (D) is the basis of growth and repair of body tissues

Q15. In C_4 plants such as maize and sugarcane, CO_2 is first fixed in the mesophyll cells. The very first stable product of this initial CO_2 fixation in the C_4 pathway is a four-carbon compound, namely:



- (A) a three-carbon phosphoglyceric acid (PGA)
- (B) ribulose-1,5-bisphosphate (RuBP)
- (C) glucose, a six-carbon sugar
- (D) oxaloacetic acid (OAA), a four-carbon acid

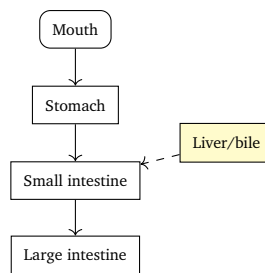


- Q16.** During the complete aerobic oxidation of one molecule of glucose (glycolysis, Krebs cycle and the electron transport chain together), the maximum net number of ATP molecules produced is about:
- (A) 2 ATP
 - (B) 4 ATP
 - (C) 38 ATP
 - (D) 686 ATP
- Q17.** On cool, humid mornings, droplets of water are often seen at the tips and margins of the leaves of small herbaceous plants, exuded through special pores called hydathodes. This loss of liquid water, driven by root pressure, is called:
- (A) guttation through hydathodes
 - (B) transpiration through stomata
 - (C) imbibition by hydrophilic colloids
 - (D) plasmolysis of leaf cells
- Q18.** Before an element is regarded as an 'essential' mineral element for a plant, it must satisfy certain criteria. One such criterion is that the element must be:
- (A) absorbed by the plant only in very large amounts
 - (B) present only in the soil and never in water culture
 - (C) useful only for the growth of the roots
 - (D) absolutely necessary for normal growth and reproduction, and not replaceable by another element
- Q19.** The plant growth regulator that acts mainly as a growth *inhibitor*, induces and maintains seed dormancy, and causes closure of stomata under water stress (so it is called the 'stress hormone') is:
- (A) auxin (IAA)



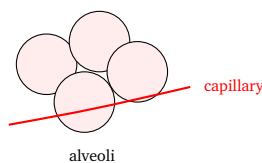
- (B) abscisic acid (ABA)
- (C) gibberellin
- (D) cytokinin

Q20. In the human alimentary canal shown, bile produced by the liver is stored in the gall bladder and released into the small intestine. Bile contains no digestive enzyme, yet it is essential for fat digestion because bile salts:



- (A) directly hydrolyse fats into fatty acids and glycerol
- (B) digest proteins into amino acids
- (C) emulsify large fat globules into tiny droplets, aiding lipase action
- (D) break down starch into maltose

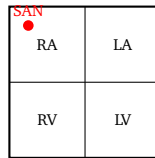
Q21. Across the thin alveolar walls shown, exchange of gases occurs with the surrounding capillaries. The volume of air that a person can breathe in (or out) during a *normal* quiet breath, called the tidal volume, is approximately:



- (A) about 500 mL
- (B) about 1100–1200 mL
- (C) about 2500–3000 mL
- (D) about 4500–5000 mL

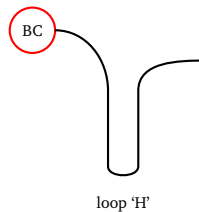


Q22. In the human heart shown, a specialised patch of nodal tissue in the wall of the right atrium generates the impulse that initiates each heartbeat, and so it is called the pacemaker of the heart. This structure is the:



- (A) atrio-ventricular node (AVN)
- (B) bundle of His
- (C) Purkinje fibres
- (D) sino-atrial node (SAN)

Q23. In the nephron shown, the hairpin-shaped tubule labelled 'H' dips into the medulla and, together with the surrounding blood vessels, sets up a counter-current that concentrates the urine. This concentrating mechanism is associated mainly with the:



- (A) Bowman's capsule and the glomerulus
- (B) the proximal convoluted tubule only
- (C) loop of Henle together with the vasa recta
- (D) the collecting duct alone, acting independently

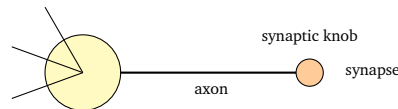
Q24. The human skeleton is divided into an axial and an appendicular part. The axial skeleton comprises the bones lying along the main axis of the body, namely:

- (A) the bones of the fore limbs and hind limbs
- (B) the skull, vertebral column, sternum and ribs

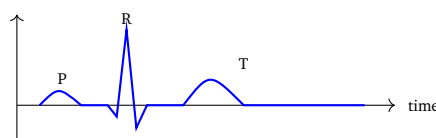


- (C) the pectoral and pelvic girdles
- (D) the bones of the hand and foot only

Q25. At the junction shown between the axon terminal of one neuron and the next cell, the nerve impulse is usually carried across the gap by chemical messengers. At such a chemical synapse, the arriving impulse causes the release of:



- (A) neurotransmitters (such as acetylcholine) from the synaptic vesicles
 - (B) bile salts into the synaptic cleft
 - (C) digestive enzymes from the knob
 - (D) red blood cells across the gap
- Q26.** In an emergency or 'fight-or-flight' situation, the adrenal medulla quickly secretes hormones that raise the heart rate, blood pressure and blood-sugar level, preparing the body for sudden action. These emergency hormones are:
- (A) insulin and glucagon
 - (B) thyroxine and calcitonin
 - (C) adrenaline (epinephrine) and noradrenaline
 - (D) oxytocin and vasopressin
- Q27.** Each normal heartbeat begins as an impulse in the SAN, which then spreads as shown in the ECG trace. From the SAN the wave of excitation passes to the AVN and is then carried rapidly to the ventricular muscle by a conducting pathway made up of:

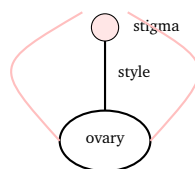


- (A) the coronary arteries of the heart
- (B) the pulmonary veins from the lungs
- (C) the vagus nerve fibres only
- (D) the bundle of His and the Purkinje fibres

Q28. When a resting nerve fibre is stimulated, the permeability of its membrane to sodium ions suddenly increases, Na^+ rushes in, and the inner side of the membrane briefly becomes positive with respect to the outside. This reversal of membrane polarity is called:

- (A) repolarisation
- (B) depolarisation
- (C) the resting potential
- (D) hyperpolarisation

Q29. The flower shown bears ovules inside the ovary. In a typical anatropous ovule, the small opening at one end through which the pollen tube usually enters the embryo sac is the:



- (A) the micropyle
- (B) the funicle (stalk of the ovule)
- (C) the chalaza (basal region)
- (D) the hilum

Q30. In many flowering plants, pollen from the same flower (or plant) fails to produce seeds even though it lands on a receptive stigma, because the pistil rejects its own pollen. This genetically controlled mechanism that prevents self-fertilization is called:



- (A) double fertilization
- (B) self-incompatibility (self-sterility)
- (C) parthenocarpy
- (D) geitonogamy

Q31. During spermatogenesis in the human testis, the diploid spermatogonia first multiply and then enter meiosis. The reduction (meiosis I) of a primary spermatocyte directly gives rise to:

- (A) four haploid spermatids at once
- (B) a single diploid spermatid
- (C) mature, motile spermatozoa straight away
- (D) two haploid secondary spermatocytes

Q32. After ovulation, the ruptured Graafian follicle left behind in the ovary is transformed into a yellowish endocrine body that secretes large amounts of progesterone to maintain the uterine lining. This structure is the:

- (A) primary follicle
- (B) Graafian follicle
- (C) corpus luteum
- (D) corpus albicans only

Q33. In the assisted reproductive technology popularly called the 'test-tube baby' programme, fertilization of the ovum by the sperm is carried out *outside* the body in the laboratory, and the early embryo is then transferred into the uterus (or fallopian tube). This technique of in-vitro fertilization is abbreviated as:

- (A) IVF (in-vitro fertilization, with embryo transfer)
- (B) IUD (intra-uterine device)
- (C) MTP (medical termination of pregnancy)
- (D) ELISA test for fertility

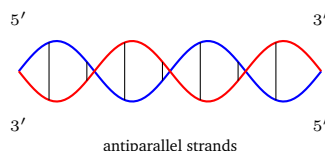


- Q34.** Mendel's Law of Dominance is best illustrated by the F_1 of a tall (TT) \times dwarf (tt) cross. According to this law, in a heterozygote (Tt):
- (A) the two alleles blend to give an intermediate (medium) height
 - (B) both alleles are expressed equally and simultaneously
 - (C) only the dominant allele is expressed, masking the recessive allele
 - (D) the recessive allele is lost from the plant altogether
- Q35.** In the human ABO blood group system, a person with the genotype $I^A I^B$ has blood group AB, expressing both A and B antigens on the red cells. This simultaneous full expression of both alleles is an example of:
- (A) incomplete dominance
 - (B) codominance
 - (C) complete dominance
 - (D) epistasis
- Q36.** In the construction of genetic (linkage) maps, the distance between two genes on a chromosome is expressed in map units. One map unit (centimorgan) corresponds to a recombination frequency of:
- (A) 10% recombinant offspring
 - (B) 50% recombinant offspring
 - (C) 100% recombinant offspring
 - (D) 1% recombinant offspring
- Q37.** In human genetics, a chart that records the occurrence of a trait across several generations of a family, using standard symbols, and is used to trace the inheritance of that trait, is called a:
- (A) karyotype
 - (B) Punnett square
 - (C) pedigree (pedigree analysis chart)



(D) test cross

Q38. In the DNA double helix shown, the two sugar-phosphate backbones run in opposite directions. According to the Watson–Crick model, the two strands of DNA are:



- (A) antiparallel, one running $5' \rightarrow 3'$ and the other $3' \rightarrow 5'$
- (B) parallel, both running $5' \rightarrow 3'$ in the same direction
- (C) identical in base sequence to each other
- (D) joined by covalent bonds between the bases

Q39. The semiconservative nature of DNA replication was experimentally proved by Meselson and Stahl using *Escherichia coli*. The heavy and light isotopes of which element did they use to label and distinguish the parental and newly made DNA strands?

- (A) carbon (^{12}C and ^{14}C)
- (B) nitrogen (^{15}N and ^{14}N)
- (C) phosphorus (^{31}P and ^{32}P)
- (D) sulphur (^{32}S and ^{35}S)

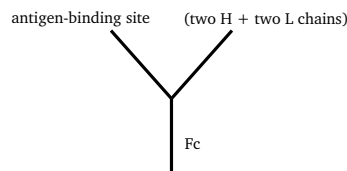
Q40. Jean-Baptiste Lamarck proposed an early theory of evolution. The central idea of Lamarckism, which was later discarded, is that evolution proceeds through the:

- (A) natural selection of favourable variations
- (B) random genetic drift in small populations
- (C) sudden appearance of large mutations
- (D) inheritance of acquired characters, gained through use and disuse of organs



- Q41.** Ascariasis is a common human disease caused by the intestinal round-worm *Ascaris lumbricoides*. A person usually acquires this infection by:
- (A) ingesting food or water contaminated with the eggs of the worm
 - (B) the bite of an infected female *Anopheles* mosquito
 - (C) sexual contact with an infected person
 - (D) inhaling air-borne droplets from a patient's cough

- Q42.** The Y-shaped immunoglobulin molecule is shown. Antibodies of this basic structure occur in five major classes in human blood and secretions. The class of antibody that is the most abundant in the blood plasma and can cross the placenta to give passive immunity to the foetus is:



- (A) IgE
 - (B) IgM
 - (C) IgG
 - (D) IgA
- Q43.** In the secondary (biological) treatment of municipal sewage, the bulk of the organic matter in the effluent is broken down chiefly by the vigorous growth and activity of:
- (A) green algae carrying out photosynthesis
 - (B) heterotrophic aerobic microbes that form flocs (activated sludge)
 - (C) large fishes feeding on the waste
 - (D) ultraviolet light alone, with no microbes
- Q44.** Apiculture is an agricultural practice that is encouraged near orchards and crop fields not only for the products it yields but also because it improves crop yield. Apiculture is the rearing of:

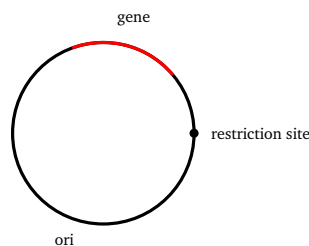


- (A) honey bees for honey, wax and for pollination of crops
- (B) silkworms for the production of silk
- (C) fish in ponds for food
- (D) lac insects for the production of lac

Q45. In recombinant DNA technology, the recombinant vector is introduced into a suitable host cell where it can multiply. The bacterium that is most commonly used as the host (recipient) cell in routine gene-cloning experiments is:

- (A) *Bacillus thuringiensis*
- (B) *Saccharomyces cerevisiae*
- (C) *Rhizobium leguminosarum*
- (D) *Escherichia coli*

Q46. Apart from using vectors, foreign DNA can be introduced directly into plant cells. The method in which the DNA is coated onto tiny high-velocity metal (gold or tungsten) particles that are literally shot into the cells is called the:



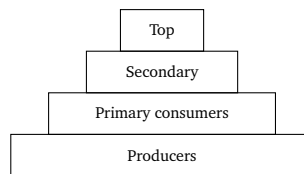
- (A) the use of a disarmed *Agrobacterium* vector
- (B) simple diffusion of DNA across the wall
- (C) biolistics (gene gun) method
- (D) gel electrophoresis of the DNA

Q47. A nematode-resistant tobacco plant has been developed using RNA interference (RNAi). In this strategy the introduced gene produces both sense and antisense RNA so that, in the parasite, it leads to the:



- (A) production of the Bt toxin that kills the nematode
- (B) silencing of a specific nematode mRNA, so that the parasite cannot survive in the host
- (C) synthesis of extra plant hormones
- (D) formation of more chlorophyll in the leaves

Q48. In an ecosystem the producers, shown at the base of the pyramid, fix solar energy. The amount of organic matter (energy) left with the producers *after* their own respiratory losses have been subtracted from the gross primary productivity is called the:



- (A) gross primary productivity (GPP)
 - (B) secondary productivity
 - (C) standing crop biomass
 - (D) net primary productivity (NPP)
- Q49.** An interaction between two species in which one species (the consumer) kills and feeds upon the other (its prey), so that one is benefited (+) and the other is harmed (–), is called:
- (A) mutualism
 - (B) commensalism
 - (C) predation
 - (D) competition
- Q50.** The conservation of threatened species by taking them *out* of their natural habitat and maintaining them under special care, for example in zoological parks, botanical gardens, seed banks and cryopreservation, is known as:



- (A) ex-situ conservation
- (B) in-situ conservation
- (C) conservation in biosphere reserves
- (D) conservation in sacred groves



Detailed Solutions

Q1.

Solution

Concept — Fungal nutrition: Fungi lack chlorophyll, so they cannot prepare their own food.

Step 1 — State how fungi feed: they secrete digestive enzymes onto organic matter and then absorb the simpler, dissolved nutrients.

Step 2 — Classify the mode: this absorptive feeding on dead matter (saprophytic) or on a living host (parasitic) is heterotrophic by absorption.

Why other options are wrong:

- (A) photoautotrophy needs chlorophyll, which fungi lack.
- (C) chemoautotrophy (oxidising inorganic substances) is shown by some bacteria, not fungi.
- (D) holozoic (ingestive) nutrition involves taking in solid food, as in animals, not absorption.

Final Answer: heterotrophic by absorption ⇒ **B**

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

Q2.

Solution

Concept — Herbarium: A herbarium is a taxonomic aid that stores plant specimens in a dried, preserved form.

Step 1 — Describe the specimens: plants are collected, pressed, dried and mounted on stiff sheets.

Step 2 — Note the labelling: each sheet bears a label giving the scientific name, family, locality, date and collector, arranged according to a classification system.

Why other options are wrong:

- (B) a garden of *living* plants is a botanical garden, not a herbarium.
- (C) a book of correct scientific names is a flora/manual.
- (D) preserved animals in jars belong to a museum, not a (plant) herbarium.

Final Answer: store of dried, pressed, labelled plant specimens ⇒ **A**



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

Q3.

Solution

Concept — Gymnosperms: The word 'gymnosperm' literally means 'naked seed'.

Step 1 — Note the absence of an ovary: in gymnosperms the ovules are not enclosed inside an ovary; they are borne exposed on the surface of megasporophylls.

Step 2 — Conclude: since the ovules are naked, the seeds that develop from them are also naked, not enclosed in a fruit.

Why other options are wrong:

- (A) enclosure of seeds in a ripened ovary (fruit) is the feature of angiosperms.
- (B) closed carpels with a stigma are found in angiosperms, not gymnosperms.
- (C) double fertilization (and triple fusion) is characteristic of angiosperms.

Final Answer: ovules and seeds are naked \Rightarrow

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

Q4.

Solution

Concept — Body cavity in Aschelminthes: The grade of the body cavity (coelom) is a key feature in animal classification.

Step 1 — Recall the roundworm cavity: in Aschelminthes the body cavity is present but is *not* lined on all sides by mesoderm.

Step 2 — Name it: such a false body cavity is called a pseudocoelom, and these animals are pseudocoelomates.

Why other options are wrong:

- (A) Platyhelminthes are acoelomate (no body cavity); roundworms do have a cavity.
- (B) a true coelom fully lined by mesoderm occurs in Annelida and higher phyla.
- (D) a haemocoel (blood-filled cavity) is characteristic of arthropods and molluscs.



Final Answer: a pseudocoelom \Rightarrow

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

Q5.

Solution

Concept — Phloem components: Phloem is made of sieve tube elements, companion cells, phloem parenchyma and phloem fibres.

Step 1 — Identify the conducting cells: food is conducted through the sieve tube elements, joined end to end through sieve plates.

Step 2 — Note their special feature: a mature sieve tube element loses its nucleus yet stays alive, and is kept functional by the nucleus of its companion cell.

Why other options are wrong:

- (B) tracheids and (C) vessel elements are dead water-conducting cells of the xylem.
- (D) phloem fibres are dead sclerenchymatous cells that give mechanical support, not conduction.

Final Answer: sieve tube elements \Rightarrow

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

Q6.

Solution

Concept — Nervous tissue: Nervous tissue is made of neurons and supporting neuroglial cells.

Step 1 — Identify the functional unit: the neuron (nerve cell) is the structural and functional unit that actually generates and conducts the nerve impulse.

Step 2 — Note the supporting cells: neuroglia merely support, nourish and insulate the neurons; they do not conduct impulses.

Why other options are wrong:

- (A) neuroglia are supporting (glial) cells, not the conducting unit.
- (B) Schwann cells form the myelin sheath around axons; they do not conduct impulses themselves.
- (D) ependymal cells line the brain cavities and do not conduct impulses.



Final Answer: the neuron \Rightarrow

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

Q7.

Solution

Concept — Types of inflorescence: Inflorescences are mainly of two kinds — racemose and cymose — depending on the fate of the main axis.

Step 1 — Read the clue: the main axis keeps growing and bears flowers laterally in acropetal order (older below, younger above).

Step 2 — Match the type: a continuously growing main axis with acropetal flowers is a racemose inflorescence.

Why other options are wrong:

- (A) in a cymose inflorescence the main axis ends in a flower and growth is checked (basipetal order).
- (C) a solitary terminal flower is a single flower, not this lateral arrangement.
- (D) a cyathium is a special inflorescence, not the type described here.

Final Answer: racemose inflorescence \Rightarrow

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

Q8.

Solution

Concept — Earthworm locomotion: The earthworm moves by waves of muscular contraction along its body, helped by tiny bristle-like structures.

Step 1 — Identify the structures: short, curved, S-shaped chitinous setae project from most segments.

Step 2 — Note their role: the setae anchor part of the body to the soil while the muscles push the rest forward.

Why other options are wrong:

- (A) parapodia are the lateral paddle-like appendages of *Nereis*, not the earthworm.
- (B) tube feet are the locomotory organs of echinoderms (starfish).
- (C) jointed walking legs are found in arthropods, not in the earthworm.



Final Answer: setae (chaetae) ⇒

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

Q9.

Solution

Concept — Golgi apparatus: The Golgi apparatus (Golgi complex) is a stack of flattened membranous sacs called cisternae.

Step 1 — State its main job: it receives materials (such as proteins) from the endoplasmic reticulum, modifies them, packages them into vesicles and dispatches them within or outside the cell.

Step 2 — Add a key role: it is also the site where lysosomes are formed.

Why other options are wrong:

- (B) ATP synthesis by aerobic respiration is the job of the mitochondria.
- (C) the genetic material is stored in the nucleus.
- (D) photosynthesis occurs in chloroplasts, which are absent in animal cells.

Final Answer: processes, packages and secretes materials and forms lysosomes ⇒

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

Q10.

Solution

Concept — Facilitated diffusion: Some solutes cannot cross the lipid bilayer freely and need the help of membrane proteins.

Step 1 — Read the key features: movement is *down* the concentration gradient and uses carrier/channel proteins but spends *no* ATP.

Step 2 — Match the term: passive, protein-assisted, energy-free transport down the gradient is facilitated diffusion.

Why other options are wrong:

- (A) active transport works against the gradient and needs ATP.
- (C) endocytosis engulfs bulk material in vesicles, an energy-requiring process.



- (D) simple diffusion needs no proteins; the question specifies protein-assisted transport.

Final Answer: facilitated diffusion \Rightarrow

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

Q11.

Solution

Concept — Nucleotide structure: Nucleic acids are polynucleotides; each nucleotide is the repeating unit.

Step 1 — List the three parts: a nitrogenous base (purine or pyrimidine), a pentose sugar (deoxyribose in DNA, ribose in RNA) and a phosphate group.

Step 2 — Note the linkage: base + sugar form a nucleoside, and adding the phosphate makes the nucleotide.

Why other options are wrong:

- (A) three fatty acids on glycerol describe a fat (triglyceride), not a nucleotide.
- (B) amino, carboxyl and R-group describe an amino acid.
- (D) a nucleotide also contains the pentose sugar, not just a base and phosphate.

Final Answer: base + pentose sugar + phosphate \Rightarrow

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

Q12.

Solution

Concept — Temperature and enzymes: Each enzyme works best at an optimum temperature; activity rises up to it and then falls.

Step 1 — Explain the fall: well above the optimum, the heat breaks the weak bonds that hold the enzyme's three-dimensional shape.

Step 2 — State the result: the enzyme is denatured, its active site is distorted, and it can no longer bind the substrate, so the rate drops sharply.

Why other options are wrong:



- (A) an enzyme is not converted into its substrate.
- (B) activity does *not* keep rising without limit; it falls after the optimum.
- (C) the enzyme does not turn into a coenzyme.

Final Answer: the enzyme is denatured \Rightarrow

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

Q13.

Solution

Concept — Mitotic anaphase: Anaphase is the stage of actual separation of the sister chromatids.

Step 1 — Recall the key event: the centromere of each chromosome splits, so the two sister chromatids become independent daughter chromosomes.

Step 2 — Note the movement: the shortening spindle fibres pull these daughter chromosomes towards opposite poles, as shown.

Why other options are wrong:

- (B) chromatin condensation and breakdown of the nuclear envelope occur in prophase.
- (C) alignment on the equatorial plate is metaphase.
- (D) reorganisation of nuclei and division of the cytoplasm is telophase/cytokinesis.

Final Answer: centromeres split and chromatids move to opposite poles \Rightarrow

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

Q14.

Solution

Concept — Significance of meiosis: Meiosis is the division that produces gametes (or spores) in sexually reproducing organisms.

Step 1 — State the first role: it reduces the chromosome number from diploid (2n) to haploid (n), so that fertilization restores the original number in the next generation.

Step 2 — State the second role: crossing over and independent assortment during meiosis shuffle the genes, generating genetic variation.



Why other options are wrong:

- (A) meiosis halves, it does not double, the chromosome number.
- (C) producing two identical diploid cells describes mitosis.
- (D) growth and repair of tissues is achieved by mitosis, not meiosis.

Final Answer: halves chromosome number and creates variation \Rightarrow

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

Q15.

Solution

Concept — C_4 pathway: In C_4 plants the primary CO_2 acceptor in the mesophyll is the three-carbon phosphoenolpyruvate (PEP).

Step 1 — Identify the fixing enzyme: PEP carboxylase fixes CO_2 onto PEP.

Step 2 — Name the first product: this gives oxaloacetic acid (OAA), a four-carbon compound; hence the name ' C_4 ' pathway.

Why other options are wrong:

- (A) the 3-carbon PGA is the first product of the C_3 (Calvin) pathway, not the C_4 initial fixation.
- (B) RuBP is the CO_2 acceptor in the Calvin cycle, not the first product here.
- (C) glucose is a much later product of photosynthesis.

Final Answer: oxaloacetic acid (OAA) \Rightarrow

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

Q16.

Solution

Concept — ATP yield of aerobic respiration: The complete aerobic breakdown of one glucose molecule is counted across all three stages.

Step 1 — Add up the stages: glycolysis nets 2 ATP (plus 2 NADH), the link reaction and Krebs cycle give more NADH/ $FADH_2$ and 2 ATP, and the electron transport chain converts the reduced coenzymes into the bulk of the ATP.

Step 2 — Give the standard figure: the maximum theoretical yield commonly quoted in NCERT is about 38 ATP per glucose.



Why other options are wrong:

- (A) 2 ATP is the *net* yield of glycolysis alone (anaerobic).
- (B) 4 ATP is the gross (not net) yield of glycolysis.
- (D) 686 is the energy in kcal released per mole of glucose, not the number of ATP.

Final Answer: about 38 ATP \Rightarrow

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

Q17.

Solution

Concept — Guttation: Guttation is the loss of liquid water as droplets from the margins/tips of leaves.

Step 1 — Identify the pores: the droplets are exuded through special water pores called hydathodes.

Step 2 — Identify the driving force: guttation occurs when absorption is high and transpiration is low (cool, humid mornings); it is driven by root pressure.

Why other options are wrong:

- (B) transpiration is the loss of water as *vapour* through stomata, not droplets.
- (C) imbibition is the absorption of water by hydrophilic colloids.
- (D) plasmolysis is the shrinking of the protoplast in a hypertonic solution.

Final Answer: guttation through hydathodes \Rightarrow

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

Q18.

Solution

Concept — Criteria of essentiality: An element is 'essential' only if it meets defined criteria laid down by Arnon and Stout.

Step 1 — State the main criterion: the element must be absolutely necessary for normal growth and reproduction, and the plant cannot complete its life cycle without it.

Step 2 — Add the related criteria: its requirement must be specific and not



replaceable by another element, and it must be directly involved in the plant's metabolism.

Why other options are wrong:

- (A) essentiality is not decided by the *quantity* absorbed; many essential elements are micronutrients.
- (B) the element can be supplied through water (hydroponics), not only through soil.
- (C) it must be needed for the whole plant, not just the roots.

Final Answer: indispensable for growth/reproduction and not replaceable ⇒

[Go Back to Q18](#)

Q19.

Solution

Concept — Abscisic acid (ABA): ABA is the chief growth-inhibiting plant hormone.

Step 1 — Match the inhibitory roles: it induces and maintains seed and bud dormancy and antagonises the growth-promoting hormones.

Step 2 — Note the stress role: under water stress it triggers the closure of stomata, conserving water; hence it is called the 'stress hormone'.

Why other options are wrong:

- (A) auxin promotes cell elongation and apical dominance.
- (C) gibberellin promotes stem elongation and breaks dormancy (opposite of ABA).
- (D) cytokinin promotes cell division and delays ageing.

Final Answer: abscisic acid (ABA) ⇒

[Go Back to Q19](#)



Q20.

Solution

Concept — Role of bile: Bile, made by the liver, contains bile salts but no digestive enzyme.

Step 1 — State the action of bile salts: they break up large fat globules into a fine suspension of tiny droplets, a process called emulsification.

Step 2 — Note the benefit: emulsification hugely increases the surface area of the fat, so that pancreatic lipase can digest it more rapidly.

Why other options are wrong:

- (A) bile cannot directly hydrolyse fats; it has no enzyme.
- (B) protein digestion is done by proteases such as trypsin, not by bile.
- (D) starch is digested by amylase, not by bile.

Final Answer: emulsifies fats, aiding lipase action ⇒

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

Q21.

Solution

Concept — Tidal volume: The respiratory volumes describe how much air is moved in different kinds of breathing.

Step 1 — Define tidal volume: it is the volume of air inspired or expired during a single *normal* (quiet) breath.

Step 2 — Give the value: in a healthy adult human this is approximately 500 mL.

Why other options are wrong:

- (B) about 1100–1200 mL is the residual volume.
- (C) about 2500–3000 mL is the inspiratory (or expiratory) reserve volume range.
- (D) about 4500–5000 mL is the vital capacity / total lung capacity range, not tidal volume.

Final Answer: about 500 mL ⇒

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



Q22.

Solution

Concept — Pacemaker of the heart: The heartbeat is myogenic, originating from a patch of special nodal tissue.

Step 1 — Locate the pacemaker: the sino-atrial node (SAN) lies in the wall of the right atrium near the opening of the superior vena cava.

Step 2 — State its role: it spontaneously generates the impulse for each beat at the fastest rate, so it sets the pace of the heart.

Why other options are wrong:

- (A) the AVN relays the impulse to the ventricles but does not normally initiate the beat.
- (B) the bundle of His conducts the impulse into the ventricles.
- (C) Purkinje fibres spread the impulse through the ventricular walls.

Final Answer: sino-atrial node (SAN) ⇒

[Go Back to Q22](#)

Q23.

Solution

Concept — Counter-current mechanism: The kidney concentrates urine using a hairpin-shaped arrangement of tubules and vessels.

Step 1 — Identify the structures: the U-shaped loop of Henle and the parallel blood capillary, the vasa recta, run close together in the medulla.

Step 2 — State the effect: their opposite (counter-current) flow builds up a steep concentration gradient of solutes in the medulla, which draws water out of the filtrate and concentrates the urine.

Why other options are wrong:

- (A) Bowman's capsule and the glomerulus carry out filtration, not the counter-current concentration.
- (B) the proximal convoluted tubule mainly reabsorbs the bulk of solutes, not the counter-current concentration.
- (D) the collecting duct responds to the gradient but does not, on its own, create it.

Final Answer: loop of Henle with the vasa recta ⇒



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

Q24.

Solution

Concept — Axial skeleton: The human skeleton has 206 bones grouped into the axial and appendicular skeletons.

Step 1 — Define the axial skeleton: it consists of the bones lying along the main longitudinal axis of the body.

Step 2 — List its parts: the skull, the vertebral column, the sternum (breast bone) and the ribs make up the axial skeleton.

Why other options are wrong:

- (A) the fore-limb and hind-limb bones are part of the appendicular skeleton.
- (C) the pectoral and pelvic girdles belong to the appendicular skeleton.
- (D) the bones of the hand and foot are appendicular, not axial.

Final Answer: skull, vertebral column, sternum and ribs \Rightarrow **B**

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

Q25.

Solution

Concept — Chemical synapse: At a chemical synapse, the impulse cannot jump the gap directly, so a chemical messenger carries it across.

Step 1 — Trace the event: the arriving impulse depolarises the synaptic knob, and the synaptic vesicles fuse with the membrane and release their contents into the synaptic cleft.

Step 2 — Name the messenger: these released chemicals are neurotransmitters (for example acetylcholine), which then act on the next neuron.

Why other options are wrong:

- (B) bile salts are involved in fat digestion, not synaptic transmission.
- (C) digestive enzymes are not released at synapses.
- (D) red blood cells transport gases in the blood; they have no role at a synapse.

Final Answer: neurotransmitters (e.g. acetylcholine) \Rightarrow **A**



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

Q26.

Solution

Concept — Adrenal medullary hormones: The inner adrenal medulla secretes catecholamines under stress.

Step 1 — Name the hormones: adrenaline (epinephrine) and noradrenaline (norepinephrine).

Step 2 — State their action: they raise the heart rate, the force of heartbeat, blood pressure and blood glucose, readying the body for 'fight or flight'; hence they are called emergency hormones.

Why other options are wrong:

- (A) insulin and glucagon are pancreatic hormones regulating blood sugar.
- (B) thyroxine and calcitonin are thyroid hormones.
- (D) oxytocin and vasopressin are released by the posterior pituitary.

Final Answer: adrenaline and noradrenaline ⇒

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

Q27.

Solution

Concept — Conducting system of the heart: The impulse for each beat follows a fixed pathway through specialised cardiac muscle.

Step 1 — Trace the pathway: SAN → AVN → bundle of His → its right and left branches → Purkinje fibres in the ventricular walls.

Step 2 — Identify the ventricular conductors: from the AVN the impulse is carried rapidly to the ventricular muscle by the bundle of His and the Purkinje fibres.

Why other options are wrong:

- (A) the coronary arteries supply blood to the heart muscle; they do not conduct impulses.
- (B) the pulmonary veins carry blood, not impulses.
- (C) the vagus nerve only modulates the rate; it is not the internal conducting



pathway.

Final Answer: bundle of His and Purkinje fibres \Rightarrow

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

Q28.

Solution

Concept — Depolarisation: At rest the inside of the nerve membrane is negative relative to the outside (the resting potential).

Step 1 — Read the event: on stimulation, the membrane's sodium channels open and Na^+ rushes inward.

Step 2 — Name the change: the inflow makes the inside briefly positive; this reversal of polarity is depolarisation, which sets up the action potential.

Why other options are wrong:

- (A) repolarisation is the *restoration* of the resting negative state (by K^+ eflux).
- (C) the resting potential is the un-stimulated polarised state, not the reversal.
- (D) hyperpolarisation makes the inside even more negative than the resting value.

Final Answer: depolarisation \Rightarrow

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

Q29.

Solution

Concept — Ovule structure: The ovule (megasporangium) has a stalk, protective coats and an embryo sac.

Step 1 — Identify the opening: at the end opposite the chalaza, the two integuments leave a small pore called the micropyle.

Step 2 — State its role: the pollen tube usually enters the embryo sac through this micropyle (porogamy).

Why other options are wrong:

- (B) the funicle is the stalk that attaches the ovule to the placenta.



- (C) the chalaza is the basal region where the integuments and nucellus join, opposite the micropyle.
- (D) the hilum is the point where the funicle joins the body of the ovule.

Final Answer: the micropyle ⇒

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

Q30.

Solution

Concept — Self-incompatibility: Many plants have a genetic device that prevents self-fertilization even when self-pollination occurs.

Step 1 — Describe the mechanism: the pistil recognises pollen from the same plant as 'self' and inhibits its germination or the growth of its pollen tube.

Step 2 — State the outcome: self-pollen therefore fails to fertilize the ovules, promoting out-breeding; this is self-incompatibility (self-sterility).

Why other options are wrong:

- (A) double fertilization is the fusion event in the embryo sac, not a barrier.
- (C) parthenocarpy is fruit development without fertilization.
- (D) geitonogamy is pollination between two flowers of the same plant; it is a type of self-pollination, not the rejection mechanism.

Final Answer: self-incompatibility ⇒

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

Q31.

Solution

Concept — Spermatogenesis: Sperm formation passes through multiplication, growth and maturation phases.

Step 1 — Track the meiotic divisions: a diploid primary spermatocyte undergoes meiosis I (the reduction division).

Step 2 — Identify the immediate product: meiosis I gives two haploid secondary spermatocytes; each of these then undergoes meiosis II to form spermatids.

Why other options are wrong:



- (A) four spermatids form only after *both* meiotic divisions, not directly from meiosis I.
- (B) the spermatids are haploid, not diploid, and are not formed singly.
- (C) spermatids must still be transformed (spermiogenesis) into sperms; meiosis I does not give mature sperm directly.

Final Answer: two haploid secondary spermatocytes ⇒ D

Answer: (D) [Go Back to Q31](#)

Q32.

Solution

Concept — Corpus luteum: After ovulation the empty follicle is not wasted but transformed into an endocrine gland.

Step 1 — Name the structure: the remaining follicular cells enlarge and form the yellow corpus luteum.

Step 2 — State its function: it secretes large amounts of progesterone, which maintains the uterine lining (endometrium) for a possible pregnancy.

Why other options are wrong:

- (A) the primary follicle is an early stage *before* ovulation.
- (B) the Graafian follicle is the mature follicle that ruptures at ovulation; the corpus luteum forms from its remains.
- (D) the corpus albicans is the later, degenerated scar of the corpus luteum, not the active progesterone-secreting body.

Final Answer: corpus luteum ⇒ C

Answer: (C) [Go Back to Q32](#)

Q33.

Solution

Concept — In-vitro fertilization (IVF): ‘Test-tube baby’ programmes use assisted reproductive technologies (ART).

Step 1 — Describe the technique: the ovum and sperms are collected and fertilization is carried out *outside* the body, in the laboratory.

Step 2 — Note the transfer: the early embryo is then transferred into the fallop-



ian tube (ZIFT) or into the uterus (IUT); the overall in-vitro method is abbreviated IVF.

Why other options are wrong:

- (B) an IUD is a contraceptive device placed in the uterus, not a fertilization method.
- (C) MTP is medical termination of pregnancy (induced abortion).
- (D) ELISA is a diagnostic test, not a reproductive technology.

Final Answer: IVF (in-vitro fertilization) ⇒

[Go Back to Q33](#)

Q34.

Solution

Concept — Law of Dominance: Mendel's first principle explains why the F_1 resembles only one parent.

Step 1 — State the law: in a heterozygote carrying two different alleles, only one allele (the dominant) is expressed in the phenotype.

Step 2 — Apply it: in Tt the dominant T is expressed (the plant is tall) and the recessive t is masked but not lost; it can reappear in the next generation.

Why other options are wrong:

- (A) blending to an intermediate is incomplete dominance, not Mendel's law of dominance.
- (B) both alleles being expressed equally is codominance.
- (D) the recessive allele is only masked, not lost; it can reappear in F_2 .

Final Answer: only the dominant allele is expressed, masking the recessive ⇒

[Go Back to Q34](#)



Q35.

Solution

Concept — Codominance: Codominance is seen when both alleles of a gene express themselves fully and independently in the heterozygote.

Step 1 — Apply to blood groups: the alleles I^A and I^B each code for a different red-cell antigen (A and B).

Step 2 — Read the genotype $I^A I^B$: both antigens A and B appear together on the red cells, giving blood group AB; neither allele masks the other.

Why other options are wrong:

- (A) incomplete dominance gives a *blended* intermediate phenotype, not both antigens together.
- (C) in complete dominance only one allele would be expressed.
- (D) epistasis is one gene masking another (different) gene, not two alleles of the same gene.

Final Answer: codominance \Rightarrow

[Go Back to Q35](#)

Q36.

Solution

Concept — Genetic map units: Linkage maps show the relative distances between genes on a chromosome.

Step 1 — Relate distance to recombination: the map distance between two genes is proportional to the frequency of recombination (crossing over) between them.

Step 2 — Define the unit: one map unit, the centimorgan (cM), equals a recombination frequency of 1%.

Why other options are wrong:

- (A) 10% recombination corresponds to 10 map units, not one.
- (B) 50% recombination is the maximum, seen for genes that assort independently.
- (C) 100% recombination is not biologically attainable for linked genes.

Final Answer: 1% recombination = 1 map unit \Rightarrow



Answer: (D) [Go Back to Q36](#)

Q37.

Solution

Concept — Pedigree analysis: In humans, controlled crosses are not possible, so inheritance is studied from family records.

Step 1 — Define the chart: a pedigree is a diagram that traces a trait through several generations of a family using standard symbols (squares for males, circles for females, etc.).

Step 2 — State its use: pedigree analysis reveals whether a trait is dominant or recessive, autosomal or sex-linked.

Why other options are wrong:

- (A) a karyotype is an arranged display of an individual's chromosomes, not a family tree.
- (B) a Punnett square predicts offspring ratios of a single cross.
- (D) a test cross is a breeding cross to find an unknown genotype, not a family chart.

Final Answer: a pedigree \Rightarrow

Answer: (C) [Go Back to Q37](#)

Q38.

Solution

Concept — Antiparallel strands: In the Watson–Crick double helix the two polynucleotide chains have opposite orientations.

Step 1 — Describe the orientation: one strand runs in the $5' \rightarrow 3'$ direction while its partner runs $3' \rightarrow 5'$.

Step 2 — Name the feature: because the two backbones point in opposite directions, the strands are said to be antiparallel.

Why other options are wrong:

- (B) the strands are not parallel; they run in opposite directions.
- (C) the two strands are complementary, not identical, in base sequence.
- (D) the bases are held by hydrogen bonds, not covalent bonds.



Final Answer: antiparallel ($5' \rightarrow 3'$ and $3' \rightarrow 5'$) \Rightarrow

Answer: (A) [Go Back to Q38](#)

Q39.

Solution

Concept — Meselson–Stahl experiment (1958): This classic experiment demonstrated that DNA replication is semiconservative.

Step 1 — Recall the labelling: *E. coli* was first grown for many generations in a medium containing the heavy nitrogen isotope ^{15}N , so all the DNA was ‘heavy’.

Step 2 — Note the shift: the cells were then shifted to a ^{14}N (light nitrogen) medium, and the densities of the DNA after successive replications were followed by centrifugation, proving the semiconservative model.

Why other options are wrong:

- (A) carbon isotopes were not used to label the DNA in this experiment.
- (C) phosphorus (^{32}P) was used by Hershey–Chase, a *different* experiment.
- (D) sulphur (^{35}S) was also used by Hershey–Chase (to label protein), not by Meselson and Stahl.

Final Answer: nitrogen (^{15}N and ^{14}N) \Rightarrow

Answer: (B) [Go Back to Q39](#)

Q40.

Solution

Concept — Lamarckism: Lamarck gave the first comprehensive theory of evolution (Theory of Inheritance of Acquired Characters).

Step 1 — State the idea of use and disuse: organs used more become better developed, while those not used degenerate during the lifetime of the organism.

Step 2 — State the inheritance claim: Lamarck believed such acquired characters are passed on to the offspring, driving evolution; this claim was later disproved.

Why other options are wrong:

- (A) natural selection of favourable variations is Darwin’s idea.
- (B) random genetic drift is a concept of modern population genetics.



- (C) evolution by sudden large mutations is de Vries's mutation theory.

Final Answer: inheritance of acquired characters (use and disuse) ⇒

Answer: (D) [Go Back to Q40](#)

Q41.

Solution

Concept — Ascariasis: Ascariasis is caused by the common intestinal roundworm *Ascaris lumbricoides*.

Step 1 — Recall the mode of spread: the eggs of the worm, passed out in the faeces of an infected person, contaminate soil, water, vegetables and food.

Step 2 — State the route: a healthy person becomes infected by ingesting these eggs along with contaminated food or water.

Why other options are wrong:

- (B) a mosquito bite transmits malaria/filariasis, not ascariasis.
- (C) ascariasis is not a sexually transmitted disease.
- (D) it does not spread mainly through inhaled droplets (that is typical of respiratory infections).

Final Answer: ingesting eggs in contaminated food/water ⇒

Answer: (A) [Go Back to Q41](#)

Q42.

Solution

Concept — Immunoglobulin classes: Human antibodies occur in five classes — IgG, IgM, IgA, IgE and IgD — with different roles.

Step 1 — Identify the most abundant: IgG is the most plentiful immunoglobulin in blood plasma.

Step 2 — Note the special property: IgG is small enough to cross the placenta, passing maternal antibodies to the foetus and giving it natural passive immunity.

Why other options are wrong:

- (A) IgE is involved in allergic reactions and is present in tiny amounts.
- (B) IgM is the large, first-formed antibody and does not cross the placenta.



- (D) IgA is found mainly in secretions such as saliva, tears and milk.

Final Answer: IgG ⇒

Answer: (C) [Go Back to Q42](#)

Q43.

Solution

Concept — Secondary sewage treatment: The biological (secondary) stage relies on microbes to consume the organic load.

Step 1 — Identify the microbes: useful aerobic, heterotrophic bacteria and other microbes are grown in well-aerated tanks.

Step 2 — State the process: they multiply rapidly and clump into masses called flocs (the ‘activated sludge’), consuming most of the organic matter and lowering the BOD of the effluent.

Why other options are wrong:

- (A) green algae are not the chief agents that degrade the organic matter here.
- (C) large fishes are not used to treat sewage.
- (D) ultraviolet light alone, without microbes, does not carry out secondary biological treatment.

Final Answer: aerobic floc-forming microbes (activated sludge) ⇒

Answer: (B) [Go Back to Q43](#)

Q44.

Solution

Concept — Apiculture: ‘Api-’ refers to the honey bee (*Apis*).

Step 1 — Define apiculture: it is the maintenance and rearing of honey bee colonies in hives for their products.

Step 2 — Note the products and benefit: it yields honey and bees-wax, and the bees, while foraging, also pollinate nearby crops and improve their yield, so hives are kept near orchards and fields.

Why other options are wrong:



- (B) rearing silkworms for silk is sericulture.
- (C) rearing fish for food is pisciculture (aquaculture).
- (D) rearing lac insects for lac is lac culture, not apiculture.

Final Answer: rearing honey bees \Rightarrow

Answer: (A) [Go Back to Q44](#)

Q45.

Solution

Concept — Host cell in cloning: After a recombinant vector is made, it must be introduced into a living cell where it can replicate.

Step 1 — Identify the usual host: the bacterium *Escherichia coli* is the most widely used host because it multiplies rapidly and is easy to handle and transform.

Step 2 — Note its role: once inside *E. coli*, the recombinant DNA is copied many times as the cells divide, producing many clones.

Why other options are wrong:

- (A) *Bacillus thuringiensis* is the source of the Bt (cry) gene, not the routine cloning host.
- (B) yeast (*Saccharomyces*) is used in some cases but is not the most common routine host.
- (C) *Rhizobium* is a nitrogen-fixing soil symbiont, not a standard cloning host.

Final Answer: *Escherichia coli* \Rightarrow

Answer: (D) [Go Back to Q45](#)

Q46.

Solution

Concept — Direct gene transfer: Apart from vector-mediated transfer, DNA can be forced directly into cells.

Step 1 — Describe the gene-gun method: the desired DNA is coated onto tiny gold or tungsten particles, which are then fired at high velocity into the target cells.

Step 2 — Name it: this is the biolistics or gene gun (particle gun) method, suitable especially for plant cells.



Why other options are wrong:

- (A) using a disarmed *Agrobacterium* is a vector-mediated method, not the particle-shooting method described.
- (B) DNA does not simply diffuse across the cell wall on its own.
- (D) gel electrophoresis is used to *separate* DNA fragments, not to deliver DNA into cells.

Final Answer: biolistics (gene gun) method ⇒

[Go Back to Q46](#)

Q47.

Solution

Concept — RNA interference (RNAi): RNAi is a cellular defence in which double-stranded RNA silences a complementary mRNA.

Step 1 — Describe the strategy: a gene introduced into the host (tobacco) produces both sense and antisense RNA, which pair to form double-stranded RNA specific to a nematode gene.

Step 2 — State the effect: this double-stranded RNA silences the corresponding nematode mRNA, so the parasite's vital gene is switched off and it cannot survive in the transgenic host.

Why other options are wrong:

- (A) the Bt toxin is a different (protein-based) pest-resistance strategy, not RNAi.
- (C) RNAi does not work by making extra plant hormones.
- (D) it does not act by increasing chlorophyll content.

Final Answer: silencing of a specific nematode mRNA ⇒

[Go Back to Q47](#)



Q48.

Solution

Concept — Primary productivity: Producers capture solar energy and build organic matter.

Step 1 — Define GPP: the gross primary productivity (GPP) is the total rate at which the producers fix energy/organic matter.

Step 2 — Subtract respiration: the producers use some of this in their own respiration (R); what is left, $GPP - R$, is the net primary productivity (NPP), the matter available to consumers.

Why other options are wrong:

- (A) GPP is the *gross* amount, before respiratory losses are subtracted.
- (B) secondary productivity refers to the rate of formation of new organic matter by consumers.
- (C) standing crop biomass is the mass of living material present at a given time, not a productivity (rate).

Final Answer: net primary productivity (NPP) \Rightarrow

[Go Back to Q48](#)

Q49.

Solution

Concept — Predation: Predation is an inter-specific interaction with opposite effects on the two species.

Step 1 — Read the clue: one species kills and eats the other, so the predator is benefited (+) and the prey is harmed (-).

Step 2 — Match the interaction: a (+/-) relationship in which one organism feeds on another is predation.

Why other options are wrong:

- (A) mutualism benefits both partners (+/+).
- (B) commensalism benefits one and leaves the other unaffected (+/0).
- (D) competition harms both species (-/-).

Final Answer: predation \Rightarrow

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Q50.

Solution

Concept — Ex-situ conservation: Conservation methods are of two broad types — in-situ (on site) and ex-situ (off site).

Step 1 — Read the clue: the species are taken *out* of their natural habitat and looked after under controlled conditions.

Step 2 — Match the term: zoological parks, botanical gardens, seed banks and cryopreservation are all ex-situ conservation methods.

Why other options are wrong:

- (B) in-situ conservation protects species *within* their natural habitat.
- (C) biosphere reserves protect species in their natural habitat, so they are in-situ.
- (D) sacred groves are patches protected in nature, again an in-situ method.

Final Answer: ex-situ conservation \Rightarrow

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Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	A	3	D	4	C	5	A
6	C	7	B	8	D	9	A	10	B
11	C	12	D	13	A	14	B	15	D
16	C	17	A	18	D	19	B	20	C
21	A	22	D	23	C	24	B	25	A
26	C	27	D	28	B	29	A	30	B
31	D	32	C	33	A	34	C	35	B
36	D	37	C	38	A	39	B	40	D
41	A	42	C	43	B	44	A	45	D
46	C	47	B	48	D	49	C	50	A

