NEST Biology Sample Paper – 7

Duration: 45 Minutes **Maximum Marks: 60**

Instructions

- This paper contains **20 Multiple Choice Questions (single correct answer)**, modelled on the Biology section of **NEST 2026**.
- Each correct answer carries **+3 marks**. There is a deduction of -1 **mark** for each incorrect answer; **no marks** are deducted for an unattempted question.
- Every question has exactly **four options**, of which only **one** is correct. Choose carefully.
- Personal calculators, log tables, mobile phones, and other electronic gadgets are strictly prohibited in the examination hall.
- A simple on-screen (virtual) calculator is provided in the computer-based test interface and may be used; blank sheets for rough work are supplied at the exam centre.

Q1. A microscopic, single-celled eukaryote isolated from sea water has two flagella, a stiff cellulose-plated cell wall, and is photosynthetic; in large numbers some such organisms cause "red tides" and release toxins. To which group of Protista does it belong?

(A) Chrysophytes (diatoms)

(B) Dinoflagellates

(C) Euglenoids

(D) Slime moulds

Q2. A tetrapod vertebrate has dry skin covered with epidermal scales, lays shelled (cleidoic) eggs on land, is poikilothermic, and breathes only through lungs throughout life. To which class does this animal belong?

(A) Amphibia

(B) Aves

(C) Reptilia

(D) Mammalia

Q3. In a pea plant (*Pisum sativum*) the terminal leaflets of the compound leaf are modified into slender, coiled, thread-like structures that twine around a support and help the weak stem to climb. These modified leaflets are

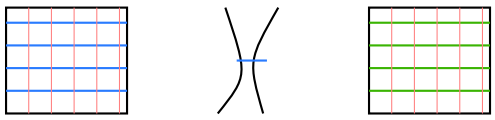
(A) leaf tendrils

(B) leaf spines

(C) phyllodes

(D) stipules

Q4. Examine the three sketches of muscle tissue below. Tissue **Z** is composed of long, unbranched, multinucleate fibres with prominent transverse striations and is attached to the bones of the limbs to bring about voluntary movement. Tissue **Z** is



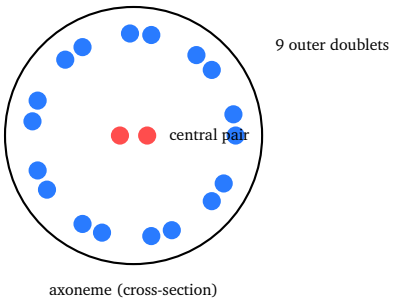
(A) smooth (visceral) muscle

(B) cardiac muscle

(C) myoepithelial tissue

(D) skeletal (striated) muscle

Q5. The cross-section of a cilium shown below reveals an axoneme made up of microtubules. The arrangement consists of nine outer doublet microtubules surrounding a central pair. This characteristic organisation is described as the



axoneme (cross-section)

(A) 9 + 0 array

(B) 9 + 1 array

(C) 9 + 2 array

(D) 11 + 0 array

Q6. In a globular protein, the local folding of a stretch of the polypeptide into a regular α-helix or β-pleated sheet, stabilised chiefly by hydrogen bonds between backbone groups, represents the protein's

(A) primary structure

(B) secondary structure

(C) tertiary structure

(D) quaternary structure

Q7. In a human being, mitosis maintains the chromosome number while meiosis halves it. Which one of the following correctly states where each division typically occurs?

(A) Mitosis in somatic (body) cells; meiosis in germ cells of the gonads

(B) Mitosis in germ cells only; meiosis in all somatic cells

(C) Both occur only in the zygote

(D) Mitosis halves and meiosis doubles the chromosome number

Q8. Cyclic photophosphorylation differs from the non-cyclic pathway in that the cyclic process

(A) involves both Photosystem I and Photosystem II and evolves oxygen

(B) produces large amounts of NADPH but no ATP

(C) splits water to release electrons and oxygen

(D) involves only Photosystem I and synthesises ATP without producing NADPH or O_2

Q9. Considering the standard accounting of cellular respiration (glycolysis, the link reaction, the Krebs cycle and oxidative phosphorylation), the net number of ATP molecules produced by the complete aerobic oxidation of one molecule of glucose is taken to be

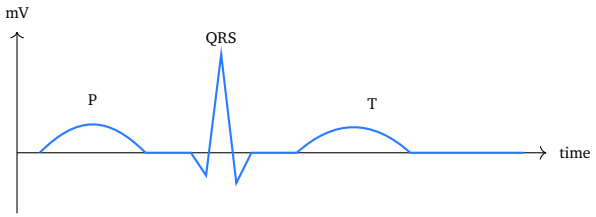
(A) 30

(B) 38

(C) 12

(D) 2

Q10. The electrocardiogram (ECG) trace below records the electrical activity of the heart. The sharp deflection labelled **QRS** represents



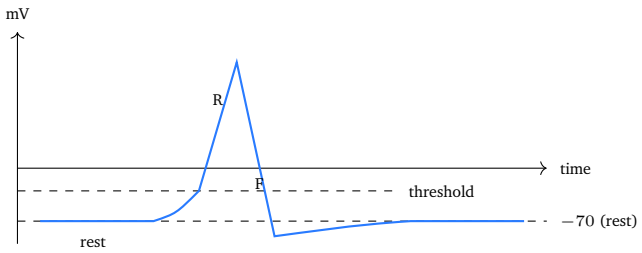
(A) atrial repolarisation

(B) depolarisation of the atria

(C) depolarisation of the ventricles

(D) repolarisation of the ventricles

Q11. The graph below shows the membrane potential of a neuron during an action potential. The rapid rising phase marked **R**, in which the inside of the membrane briefly becomes positive, is caused mainly by



(A) efflux of K^+ out of the neuron

(B) the Na^+/K^+ pump moving ions against the gradient

(C) closure of all voltage-gated channels

(D) rapid influx of Na^+ into the neuron (depolarisation)

Q12. In a typical flowering plant, the functional megaspore divides mitotically to form the embryo sac. In the common monosporic (Polygonum-type) development, the mature female gametophyte (embryo sac) is

(A) 7-celled and 8-nucleate

(B) 8-celled and 8-nucleate

(C) 4-celled and 4-nucleate

(D) 2-celled and 2-nucleate

Q13. In the human female menstrual cycle, the mid-cycle surge that directly triggers ovulation (release of the ovum from the mature Graafian follicle) is a sharp rise in

(A) progesterone from the corpus luteum

(B) follicle-stimulating hormone (FSH)

(C) luteinising hormone (LH)

(D) gonadotropin-releasing hormone (GnRH) alone

Q14. From his experiments on *Drosophila*, Morgan observed that two genes located far apart on the same chromosome show a higher recombination frequency than two genes located close together. This is because

(A) distant genes assort independently like genes on different chromosomes always do

(B) crossing over is more likely to occur between genes that are farther apart

(C) closely linked genes mutate more frequently than distant ones

(D) recombination frequency is unrelated to the distance between genes

Q15. During translation in a cell, the type of RNA that carries a specific amino acid to the ribosome and recognises the codon on the messenger RNA through its anticodon is

(A) messenger RNA (mRNA)

(B) ribosomal RNA (rRNA)

(C) transfer RNA (tRNA)

(D) heterogeneous nuclear RNA (hnRNA)

Q16. A small group of individuals leaves a large mainland population and colonises a remote island. Purely by chance, this founding group happens to carry allele frequencies very different from those of the original population. This change in the gene pool of the new population is an example of

(A) the founder effect (a form of genetic drift)

(B) natural selection favouring the fittest

(C) gene flow between two large populations

(D) directed mutation in response to the new habitat

Q17. A patient develops gross swelling of the limbs and lower body (elephantiasis) caused by chronic blockage of the lymphatic vessels by a thread-like filarial worm. The causative organism, transmitted by the bite of a mosquito, is

(A) *Ascaris lumbricoides*

(B) *Wuchereria bancrofti*

(C) *Entamoeba histolytica*

(D) *Plasmodium vivax*

Q18. The first antibiotic, penicillin, was discovered by Alexander Fleming from a mould and later purified and developed into a drug by Ernst Chain and Howard Florey. The mould that produces penicillin is

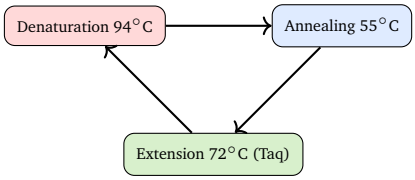
(A) *Penicillium notatum*

(B) *Streptomyces griseus*

(C) *Aspergillus niger*

(D) *Saccharomyces cerevisiae*

Q19. The diagram represents one cycle of the polymerase chain reaction (PCR). The step at 94 °C, in which the double-stranded DNA template is separated into two single strands by breaking the hydrogen bonds, is called



(A) annealing

(B) extension (elongation)

(C) ligation

(D) denaturation

Q20. In an ecosystem, the gross primary productivity (GPP) is the total rate at which producers capture and store energy by photosynthesis. The net primary productivity (NPP) available to consumers is obtained from GPP by

(A) adding the energy lost as heat to the surroundings

(B) adding the respiratory losses of the producers

(C) subtracting the respiratory losses of the producers (NPP = GPP − R)

(D) subtracting the energy fixed by decomposers

Detailed Solutions

Q1.

Solution

Concept — Dinoflagellates: Dinoflagellates are mostly marine, photosynthetic protists with two flagella and a cell wall of stiff cellulose plates. Rapid blooms of red dinoflagellates colour the sea ("red tides") and release toxins that can kill fish.

Step 1 — Match the clues: Two flagella + cellulose plates + photosynthetic + red tide with toxins points uniquely to the dinoflagellates.

Why other options are wrong:

- (A) Chrysophytes (diatoms) have silica cell walls (frustules) that fit like a soap-box, not cellulose plates.
- (C) Euglenoids are mostly fresh-water, lack a cell wall (have a pellicle), and do not cause red tides.
- (D) Slime moulds are saprophytic, form aggregating plasmodia, and are not photosynthetic flagellates.

Final Answer: The organism is a dinoflagellate $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q1

Q2.

Solution

Concept — Class Reptilia: Reptiles are poikilothermic tetrapods with a dry, cornified skin bearing epidermal scales. They breathe only by lungs and lay shelled (cleidoic) eggs on land, freeing them from water for breeding.

Step 1 — Match the features: Dry scaly skin + land-laid shelled eggs + cold-blooded + lung breathing all confirm Reptilia.

Why other options are wrong:

- (A) Amphibians have moist glandular skin and lay jelly-coated eggs in water; larvae breathe by gills.
- (B) Aves are warm-blooded (homeothermic) and have feathers.
- (D) Mammals are warm-blooded, have hair and mammary glands, and are mostly viviparous.

Final Answer: The animal belongs to Reptilia $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q2

Q3.

Solution

Concept — Leaf tendrils: In some climbers, the whole leaf or its leaflets are modified into slender, coiled tendrils that coil around a support and help the plant climb. In the garden pea, the upper leaflets of the compound leaf become leaf tendrils.

Step 1 — Identify the modification: Coiled, thread-like, climbing structures derived from leaflets are leaf tendrils.

Why other options are wrong:

- (B) Leaf spines (e.g. in *Opuntia*) are pointed and protective, not coiled climbing organs.
- (C) A phyllode is a flattened, leaf-like petiole (e.g. *Acacia*), used for photosynthesis.
- (D) Stipules are small outgrowths at the leaf base; they are not the coiled terminal leaflets.

Final Answer: The structures are leaf tendrils $\Rightarrow$ A

Answer: (A) Go Back to Q3

Q4.

Solution

Concept — Skeletal (striated) muscle: Skeletal muscle fibres are long, cylindrical, unbranched and multinucleate (nuclei at the periphery) with prominent transverse striations. They attach to bones via tendons and produce voluntary movement.

Step 1 — Read the figure: Long, unbranched, striated fibres attached to limb bones and under voluntary control describe skeletal muscle (tissue Z).

Why other options are wrong:

- (A) Smooth (visceral) muscle has spindle-shaped, uninucleate, non-striated fibres in the walls of hollow organs.
- (B) Cardiac muscle is striated but branched and uninucleate, with intercalated discs, found only in the heart.

- (C) Myoepithelial tissue is not one of the three standard muscle types described here.

Final Answer: Tissue Z is skeletal (striated) muscle $\Rightarrow$ D

Answer: (D) Go Back to Q4

Q5.

Solution

Concept — 9 + 2 axoneme: The core of a eukaryotic cilium or flagellum, the axoneme, has nine peripheral doublet microtubules arranged in a ring around two single central microtubules. This is the universal "9 + 2" pattern; the basal body (centriole) shows a 9 + 0 array.

Step 1 — Count from the figure: Nine outer doublets + one central pair = 9 + 2 array.

Why other options are wrong:

- (A) The 9 + 0 array (no central pair) is the structure of the basal body/centriole, not the axoneme.
- (B) There is a central *pair*, not a single central tubule, so it is not 9 + 1.
- (D) The peripheral tubules number nine doublets, not eleven, and a central pair is present.

Final Answer: The arrangement is the 9 + 2 array $\Rightarrow$ C

Answer: (C) Go Back to Q5

Q6.

Solution

Concept — Secondary structure of proteins: The secondary structure is the regular local folding of the polypeptide backbone into α-helices or β-pleated sheets, stabilised by hydrogen bonds between the C$=$O and N$-$H groups of the backbone.

Step 1 — Match the description: Local α-helix / β-sheet held by backbone hydrogen bonds = secondary structure.

Why other options are wrong:

- (A) Primary structure is just the linear sequence of amino acids joined by peptide bonds.

- (C) Tertiary structure is the overall three-dimensional folding of the whole chain.
- (D) Quaternary structure is the assembly of two or more polypeptide subunits (e.g. haemoglobin).

Final Answer: The α-helix / β-sheet level is the secondary structure $\Rightarrow$ B

Answer: (B) Go Back to Q6

Q7.

Solution

Concept — Location of mitosis and meiosis: Mitosis occurs in somatic (body) cells and in growth/repair, producing diploid daughter cells identical to the parent. Meiosis occurs in the germ (reproductive) cells of the gonads and forms haploid gametes, halving the chromosome number.

Step 1 — Match site to division: Body cells $\rightarrow$ mitosis; germ cells of testes/ovaries $\rightarrow$ meiosis.

Why other options are wrong:

- (B) Somatic cells divide by mitosis, not meiosis; the statement is reversed.
- (C) Both divisions are not confined to the zygote; the zygote divides by mitosis.
- (D) Mitosis keeps the chromosome number constant and meiosis halves it; this option reverses both.

Final Answer: Mitosis in somatic cells, meiosis in gonadal germ cells $\Rightarrow$ A

Answer: (A) Go Back to Q7

Q8.

Solution

Concept — Cyclic photophosphorylation: In cyclic photophosphorylation only Photosystem I is active. The excited electron returns to PS I through the electron transport chain, synthesising only ATP. No NADPH is formed, water is not split, and no oxygen is evolved.

Step 1 — Compare the two pathways: The cyclic route uses PS I alone and gives ATP only; the non-cyclic route uses PS I and PS II, splits water, evolves O_2 and makes both ATP and NADPH.

Why other options are wrong:

- (A) Involving both photosystems and evolving O_2 describes the *non-cyclic* pathway.
- (B) The cyclic pathway makes ATP, not NADPH.
- (C) Photolysis of water occurs in the non-cyclic pathway, not the cyclic one.

Final Answer: Cyclic uses only PS I and makes ATP, no NADPH or $O_2 \Rightarrow$ D

Answer: (D) Go Back to Q8

Q9.

Solution

Concept — Net ATP from aerobic respiration: In the standard NCERT accounting, the complete aerobic oxidation of one glucose molecule yields a net of 38 ATP: 2 (net) from glycolysis, 2 from the Krebs cycle (GTP), and the remainder from oxidative phosphorylation of the NADH and $FADH_2$ produced.

Step 1 — Add the contributions: Glycolysis (net 2 ATP + 2 NADH), link reaction (2 NADH), Krebs cycle (2 ATP + 6 NADH + 2 $FADH_2$); oxidising 10 NADH and 2 $FADH_2$ via the ETC totals 38 ATP.

Why other options are wrong:

- (A) 30 is a lower modern estimate but not the value used in the standard NCERT calculation here.
- (C) 12 is the ATP yield from one turn of the Krebs cycle for one acetyl group, not for whole glucose.
- (D) 2 is only the net ATP of glycolysis alone.

Final Answer: Net yield is 38 ATP per glucose $\Rightarrow$ B

Answer: (B) Go Back to Q9

Q10.

Solution

Concept — The QRS complex: In an ECG the P wave records depolarisation of the atria, the QRS complex records depolarisation of the ventricles (which initiates ventricular contraction), and the T wave records repolarisation of the ventricles.

Step 1 — Match wave to event: The sharp QRS spike = ventricular depolarisation.

Why other options are wrong:

- (A) Atrial repolarisation is masked by the larger QRS and is not the QRS itself.
- (B) Atrial depolarisation is shown by the P wave, not QRS.
- (D) Ventricular repolarisation is represented by the T wave.

Final Answer: QRS represents ventricular depolarisation $\Rightarrow$ C

Answer: (C) Go Back to Q10

Q11.

Solution

Concept — Depolarisation of a neuron: At rest the membrane is about -70 mV (inside negative), kept so by the Na^+/K^+ pump. When a stimulus reaches threshold, voltage-gated Na^+ channels open and Na^+ rushes in, making the inside positive: this rapid rise is depolarisation.

Step 1 — Identify the rising phase: The steep rise R, with the interior turning positive, is due to the fast influx of Na^+.

Why other options are wrong:

- (A) K^+ efflux causes the *falling* phase (repolarisation), not the rise.
- (B) The Na^+/K^+ pump restores the resting gradient slowly; it does not cause the rapid spike.
- (C) Closure of all channels would give no change in potential, not a rapid rise.

Final Answer: The rising phase is due to Na^+ influx (depolarisation) $\Rightarrow$ D

Answer: (D) Go Back to Q11

Q12.

Solution

Concept — Polygonum-type embryo sac: In the common monosporic development, the functional megaspore undergoes three free-nuclear mitotic divisions to give 8 nuclei, which organise into 7 cells: an egg apparatus (one egg + two synergids), three antipodal cells, and one large central cell with two polar nuclei. Hence it is 7-celled and 8-nucleate.

Step 1 — Count cells and nuclei: 8 nuclei, but two of them (the polar nuclei) lie in a single central cell, so the cell count is 7.

Why other options are wrong:

- (B) "8-celled" wrongly counts the two polar nuclei as two separate cells.
- (C) 4-celled, 4-nucleate corresponds to an earlier stage, not the mature sac.
- (D) 2-celled, 2-nucleate is far too early in development.

Final Answer: The mature embryo sac is 7-celled and 8-nucleate $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q12

Q13.

Solution

Concept — LH surge and ovulation: GnRH from the hypothalamus stimulates the anterior pituitary to release FSH and LH. A sharp mid-cycle surge of luteinising hormone (LH) directly induces rupture of the mature Graafian follicle and release of the ovum (ovulation).

Step 1 — Identify the trigger: The hormone that surges at mid-cycle to cause ovulation is LH.

Why other options are wrong:

- (A) Progesterone (from the corpus luteum) maintains the endometrium *after* ovulation; it does not trigger it.
- (B) FSH chiefly drives follicular growth; the ovulatory trigger is the LH surge.
- (D) GnRH acts upstream on the pituitary; it does not directly rupture the follicle.

Final Answer: Ovulation is triggered by the LH surge $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q13

Q14.

Solution

Concept — Linkage and recombination: Morgan found that genes on the same chromosome are linked. The chance of a crossover (recombination) between two genes increases with the physical distance between them, so distant genes recombine more often. Recombination frequency is therefore used to map gene distance.

Step 1 — Relate distance to frequency: Greater distance $\rightarrow$ more room for crossing over $\rightarrow$ higher recombination frequency.

Why other options are wrong:

- (A) Linked genes do not assort fully independently; only genes on different chromosomes do.
- (C) Recombination here results from crossing over, not from a higher mutation rate.
- (D) Recombination frequency is directly related to gene distance, so it is not unrelated.

Final Answer: Distant genes cross over more often, raising recombination $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q14

Q15.

Solution

Concept — Transfer RNA (tRNA): The central dogma is DNA $\rightarrow$ RNA $\rightarrow$ protein. During translation, tRNA acts as the adapter: one end carries a specific amino acid, while its anticodon loop base-pairs with the complementary codon on mRNA, delivering the correct amino acid to the ribosome.

Step 1 — Match role to RNA: Carries an amino acid + reads the codon via an anticodon = tRNA.

Why other options are wrong:

- (A) mRNA carries the genetic message (codons); it does not carry amino acids.
- (B) rRNA is structural and catalytic in the ribosome; it has no anticodon.
- (D) hnRNA is the unprocessed primary transcript in the nucleus, not the amino-acid carrier.

Final Answer: The adapter molecule is tRNA $\Rightarrow$ $\boxed{\text{C}}$

Answer: (C) Go Back to Q15

Q16.

Solution

Concept — Founder effect: Genetic drift is random change in allele frequencies, strongest in small populations. The founder effect is a form of drift in which a few individuals start a new population whose gene pool, by chance, differs from the parent population.

Step 1 — Match the scenario: A small founding group on an island with chance-altered allele frequencies is the founder effect.

Why other options are wrong:

- (B) Natural selection acts on fitness differences, not on the random sampling described here.
- (C) Gene flow is the movement of alleles *between* populations; the island group is now isolated.
- (D) Mutations are random and not directed by the new habitat's needs.

Final Answer: The change is due to the founder effect (genetic drift) $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q16

Q17.

Solution

Concept — Filariasis: Lymphatic filariasis (elephantiasis) is caused by the filarial worms *Wuchereria bancrofti* (and *W. malayi*). The adult worms live in and block the lymphatic vessels, causing gross swelling of the affected parts. The parasite is transmitted by the bite of female mosquitoes.

Step 1 — Match symptom to parasite: Lymphatic blockage + elephantiasis + mosquito vector = *Wuchereria*.

Why other options are wrong:

- (A) *Ascaris lumbricoides* causes ascariasis (intestinal roundworm infection), not lymphatic swelling.
- (C) *Entamoeba histolytica* causes amoebiasis (amoebic dysentery) of the gut.
- (D) *Plasmodium vivax* causes malaria, with cyclical fever, not elephantiasis.

Final Answer: The cause of elephantiasis is *Wuchereria bancrofti* $\Rightarrow$ $\boxed{\text{B}}$

Answer: (B) Go Back to Q17

Q18.

Solution

Concept — Penicillin: Penicillin, the first antibiotic, was discovered by Alexander Fleming in 1928 from the mould *Penicillium notatum* (now *P. chrysogenum*). Ernst Chain and Howard Florey later established its therapeutic value; the three shared the Nobel Prize. Antibiotics are chemicals produced by microbes that kill or inhibit other microbes.

Step 1 — Match drug to source: Penicillin is produced by the mould *Penicillium notatum*.

Why other options are wrong:

- (B) *Streptomyces griseus* yields streptomycin, not penicillin.
- (C) *Aspergillus niger* is used to produce citric acid.
- (D) *Saccharomyces cerevisiae* is baker's/brewer's yeast, not the source of penicillin.

Final Answer: Penicillin comes from *Penicillium notatum* $\Rightarrow$ $\boxed{\text{A}}$

Answer: (A) Go Back to Q18

Q19.

Solution

Concept — Denaturation in PCR: PCR amplifies DNA through repeated cycles of three steps: denaturation (about 94°C) separates the double strands by breaking hydrogen bonds; annealing (about 55°C) lets primers bind; extension (about 72°C) lets the heat-stable Taq DNA polymerase synthesise new strands.

Step 1 — Match step to temperature: Strand separation at 94°C is the denaturation step.

Why other options are wrong:

- (A) Annealing (about 55°C) is the binding of primers, not strand separation.
- (B) Extension (about 72°C) is the synthesis of new strands by Taq polymerase.
- (C) Ligation is not a step of the PCR thermal cycle.

Final Answer: Strand separation at 94°C is denaturation $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q19

Q20.

Solution

Concept — Net primary productivity: Gross primary productivity (GPP) is the total energy fixed by producers in photosynthesis. Producers themselves use part of this in respiration (R). The energy left over and stored as biomass, available to consumers, is the net primary productivity: NPP = GPP − R.

Step 1 — Apply the relation: NPP is obtained by subtracting the producers' respiratory losses from GPP.

Why other options are wrong:

- (A) Heat losses are subtracted, not added, and are part of respiratory loss.
- (B) Respiration is subtracted from GPP, not added to it.
- (D) NPP is defined relative to producer respiration, not to the energy fixed by decomposers.

Final Answer: NPP = GPP − R (producer respiration) ⇒ C

Answer: (C) Go Back to Q20

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	C	3	A	4	D	5	C
6	B	7	A	8	D	9	B	10	C
11	D	12	A	13	C	14	B	15	C
16	A	17	B	18	A	19	D	20	C