

NEST Biology Sample Paper – 4

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. Acellular and borderline entities differ sharply in their composition. Which one of the following statements is **correct**?

- (A) Viroids are infectious particles made only of protein, with no nucleic acid.
- (B) Prions are free RNA molecules that cause plant diseases such as potato spindle tuber disease.
- (C) A lichen is a symbiotic association between a fungus and a photosynthetic alga or cyanobacterium.
- (D) Viruses possess both DNA and RNA together as their genetic material in every case.

Q2. In a haplo-diplontic life cycle the gametophyte and the sporophyte are both multicellular. Which plant group shows a dominant, free-living



sporophyte and a small, dependent gametophyte that is retained on the parent plant?

- (A) Bryophytes (e.g. *Funaria*)
- (B) Pteridophytes (e.g. *Selaginella*)
- (C) Green algae (e.g. *Volvox*)
- (D) Liverworts (e.g. *Marchantia*)

Q3. A flower is described by the floral formula $\oplus \frac{\%}{K_{(5)} C_{(5)} A_5 \underline{G}_{(2)}}$, with a bicarpellary, syncarpous superior ovary, axile placentation and stamens epipetalous. To which family does this flower most likely belong?

- (A) Solanaceae
- (B) Fabaceae
- (C) Liliaceae
- (D) Poaceae

Q4. The diagram shows four animal connective tissues grouped by the consistency of their matrix. Which labelled tissue has a **fluid** matrix that contains no fibres in the resting state?

Connective tissues by matrix type

P: tendon

Q: cartilage

R: bone

S: blood

- (A) P (tendon)
- (B) Q (cartilage)
- (C) S (blood)
- (D) R (bone)

Q5. A membrane-bound organelle in animal cells contains hydrolytic enzymes active at acidic pH and is responsible for intracellular digestion of worn-out organelles. Which organelle is being described, and what is its common nickname?



- (A) Ribosome — the “protein factory”
- (B) Lysosome — the “suicide bag” of the cell
- (C) Peroxisome — the “power house” of the cell
- (D) Vacuole — the “packaging unit” of the cell

Q6. Regarding the chemical make-up of nucleic acids, which one of the following statements is **correct**?

- (A) A nucleotide consists of a nitrogenous base and a sugar only, with no phosphate group.
- (B) DNA contains the sugar ribose, whereas RNA contains deoxyribose.
- (C) Thymine is found in RNA, while uracil replaces it in DNA.
- (D) In a nucleotide the phosphate is linked to the sugar, which in turn is linked to the nitrogenous base.

Q7. A diploid cell with $2n = 8$ chromosomes undergoes meiosis. Compared with a single mitotic division of the same cell, meiosis differs in that it

- (A) involves two successive divisions and yields four haploid cells, each with $n = 4$ chromosomes.
- (B) involves one division and yields two diploid cells, each with $2n = 8$ chromosomes.
- (C) involves two divisions and yields four diploid cells, each with $2n = 8$ chromosomes.
- (D) involves one division and yields four haploid cells, each with $n = 4$ chromosomes.

Q8. During photosynthesis, carotenoids and other accessory pigments perform an important role. Which statement about photosynthetic pigments is **correct**?

- (A) Chlorophyll *a* absorbs maximally in the green region, which is why leaves appear green.



- (B) Accessory pigments are the sole reaction-centre pigments that carry out the photochemical event.
- (C) Accessory pigments absorb light at wavelengths other than chlorophyll *a* and transfer the energy to it, also protecting it from photo-oxidation.
- (D) The action spectrum of photosynthesis has no relationship with the absorption spectrum of chlorophyll *a*.

Q9. The respiratory quotient (RQ) is the ratio of the volume of CO₂ evolved to the volume of O₂ consumed during respiration. For which respiratory substrate is the RQ **exactly 1.0**?

- (A) Fats (e.g. tripalmitin)
- (B) Carbohydrates (e.g. glucose)
- (C) Proteins
- (D) Organic acids (e.g. malic acid)

Q10. Concerning human blood, its cellular and plasma components, and clotting, which one of the following statements is **correct**?

- (A) Plasma makes up about 90% of blood volume and is mostly composed of red pigment.
- (B) An individual with blood group AB is the universal donor and has anti-A and anti-B antibodies.
- (C) Erythrocytes carry out phagocytosis and are the main cells of the immune response.
- (D) The plasma protein fibrinogen is converted to fibrin during blood clotting, trapping cells to form a clot.

Q11. Match each endocrine gland in the schematic with the hormone it secretes. Which pairing is **correct**?

1

Thyroid

2

Adrenal cortex

3

Pancreas (β)

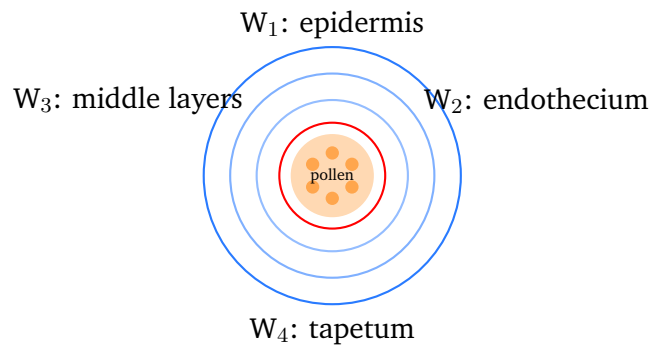
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Ant. pituitary



- (A) 1 → thyroxine, 2 → cortisol, 3 → insulin, 4 → growth hormone
 (B) 1 → insulin, 2 → thyroxine, 3 → cortisol, 4 → glucagon
 (C) 1 → cortisol, 2 → insulin, 3 → growth hormone, 4 → thyroxine
 (D) 1 → growth hormone, 2 → glucagon, 3 → thyroxine, 4 → cortisol

Q12. The transverse section of a young anther shows a microsporangium bounded by four wall layers, labelled W_1 to W_4 from outside to inside. Which layer (the innermost) nourishes the developing pollen grains?



- (A) W_1 — epidermis
 (B) W_2 — endothecium
 (C) W_4 — tapetum
 (D) W_3 — middle layers
- Q13.** Spermatogenesis and oogenesis are both forms of gametogenesis but differ in their products. Which one of the following statements is **correct**?
- (A) One primary spermatocyte forms two functional sperm, while one primary oocyte forms four ova.
 (B) One primary spermatocyte forms four sperm, while one primary oocyte forms a single ovum and polar bodies.
 (C) Both processes yield four equal-sized functional gametes from each precursor cell.
 (D) Oogenesis is completed before birth, whereas spermatogenesis begins only at puberty in both number and timing identically.

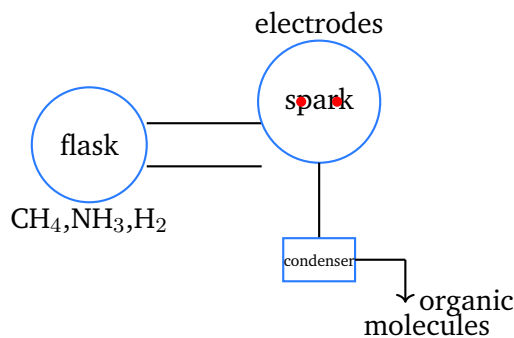


- Q14.** In garden pea, tall (T) is dominant over dwarf (t). A tall plant of unknown genotype is test-crossed with a dwarf plant. The Punnett square of the cross is shown for the case in which the tall parent is heterozygous. What ratio of tall to dwarf offspring is expected in this case?

		tall (Tt)	
		T	t
dwarf	t	Tt	tt
	t	Tt	tt

- (A) 3 tall : 1 dwarf
- (B) all tall
- (C) 1 tall : 3 dwarf
- (D) 1 tall : 1 dwarf
- Q15.** The genetic code has several defining properties. Which one of the following statements about the genetic code is **correct**?
- (A) The code is a triplet, degenerate and (nearly) universal, and is read in a non-overlapping, comma-less manner.
- (B) Each amino acid is specified by exactly one codon, so the code is non-degenerate.
- (C) The code is read with overlaps, so a single base belongs to two adjacent codons.
- (D) The code is entirely different in bacteria, plants and animals, having no universality at all.
- Q16.** The schematic shows the apparatus used in a classic experiment on chemical evolution. Electric sparks were passed through a gaseous mixture of CH_4 , NH_3 , H_2 and water vapour. Whose hypothesis did this experiment support, and who performed it?





- (A) Pasteur's biogenesis; performed by Spallanzani.
- (B) Panspermia hypothesis; performed by Darwin.
- (C) Oparin–Haldane hypothesis of chemical evolution; performed by Miller and Urey.
- (D) Theory of special creation; performed by Mendel.

Q17. Immunity in humans is broadly classified into innate and acquired types. Which one of the following correctly describes a feature of these immunities?

- (A) Innate immunity is highly specific and develops memory against each pathogen.
- (B) Passive immunity is conferred when ready-made antibodies are given directly, as in anti-tetanus serum, giving immediate but short-lived protection.
- (C) Vaccination provides passive immunity by injecting antibodies that the body never makes itself.
- (D) Active immunity gives instant protection but is always short-lived and never produces memory cells.

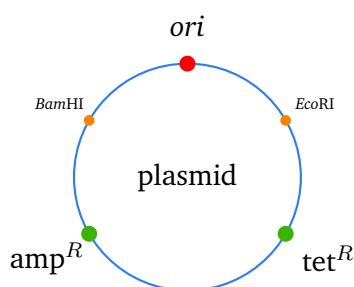
Q18. Microbes are exploited in biogas production and as biofertilizers. Which one of the following statements is **correct**?

- (A) Methanogens such as *Methanobacterium* produce oxygen as the main component of biogas.



- (B) *Rhizobium* is a free-living soil fungus that has no role in nitrogen fixation.
- (C) Mycorrhiza is a harmful parasitic association that kills the roots of higher plants.
- (D) *Rhizobium* fixes atmospheric nitrogen in root nodules of legumes, while mycorrhizal fungi help absorb phosphorus.

Q19. The map shows a typical plasmid cloning vector. Which set of features makes it a useful cloning vector?



- (A) An origin of replication (*ori*), one or more selectable markers (e.g. amp^R), and unique restriction sites for inserting foreign DNA.
- (B) Only a single restriction site and no origin of replication, so it cannot replicate in the host.
- (C) No selectable marker, making it impossible to distinguish transformed from non-transformed cells.
- (D) Multiple origins of replication but no restriction sites, so DNA cannot be inserted.
- Q20.** Ecological pyramids represent number, biomass or energy at successive trophic levels. Which one of the following statements is **correct**?
- (A) The pyramid of energy can be inverted in a grassland ecosystem.
- (B) The pyramid of energy is always upright, since energy is lost at each trophic transfer.
- (C) The pyramid of biomass can never be inverted in any ecosystem.
- (D) In all ecosystems the pyramid of numbers is always upright without exception.



Detailed Solutions

Q1.

Solution

Concept — Acellular and borderline entities: Viruses are nucleoprotein particles; viroids are free infectious RNA; prions are infectious proteins; lichens are symbiotic associations.

Step 1 — Identify the true statement: A lichen is a mutualistic partnership between a fungus (mycobiont) and a photosynthetic alga or cyanobacterium (phycobiont). This is correct.

Why other options are wrong:

- (A) Viroids are free *RNA*, not protein.
- (B) Prions are infectious *proteins*, not RNA; potato spindle tuber is caused by a viroid.
- (D) A given virus has *either* DNA or RNA, never both.

Final Answer: A lichen is a fungus–alga/cyanobacterium symbiosis ⇒

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

Q2.

Solution

Concept — Alternation of generations: In a haplo-diplontic cycle both gametophyte and sporophyte are multicellular. The dominance of either phase distinguishes the groups.

Step 1 — Identify the group: In pteridophytes (e.g. *Selaginella*) the sporophyte is the dominant, free-living plant, while the gametophyte (prothallus) is small and short-lived. This matches the description.

Why other options are wrong:

- (A) In bryophytes (*Funaria*) the *gametophyte* is dominant and the sporophyte is dependent.
- (C) *Volvox* is haplontic (dominant haploid phase).
- (D) *Marchantia* is a liverwort (bryophyte) with a dominant gametophyte.

Final Answer: Pteridophytes (*Selaginella*) ⇒

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



Q3.

Solution

Concept — Floral formula and family: The symbols encode symmetry, calyx, corolla, androecium and gynoecium.

Step 1 — Decode: $K_{(5)}$ gamosepalous calyx, $C_{(5)}$ gamopetalous corolla, A_5 epipetalous stamens, $\underline{G}_{(2)}$ bicarpellary syncarpous superior ovary with axile placentation. These are the diagnostic features of Solanaceae.

Why other options are wrong:

- (B) Fabaceae has a zygomorphic flower, C_5 papilionaceous, diadelphous stamens and a monocarpellary superior ovary.
- (C) Liliaceae is trimerous ($3 + 3$ tepals, A_6 , $G_{(3)}$).
- (D) Poaceae has a much-reduced grass flower, not pentamerous.

Final Answer: Solanaceae \Rightarrow

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

Q4.

Solution

Concept — Connective tissues by matrix: Connective tissues are classified by the consistency of their extracellular matrix: loose/dense (fibrous), cartilage (solid but pliable), bone (hard, calcified) and blood (fluid).

Step 1 — Identify the fluid-matrix tissue: Blood (S) is a fluid connective tissue whose matrix is plasma; it has no fibres in the resting state (fibrinogen polymerises only during clotting).

Why other options are wrong:

- (A) Tendon is dense regular connective tissue, a solid fibrous matrix.
- (B) Cartilage has a solid, pliable matrix (chondrin).
- (D) Bone has a hard, calcified matrix.

Final Answer: S (blood) has a fluid matrix \Rightarrow

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



Q5.

Solution

Concept — Lysosomes: Lysosomes are single-membrane organelles filled with acid hydrolases that digest macromolecules and worn-out organelles (autophagy).

Step 1 — Match description to organelle: The acidic hydrolytic enzymes and intracellular digestion point to the lysosome, nicknamed the “suicide bag” because its rupture can digest the cell.

Why other options are wrong:

- (A) Ribosomes synthesise protein and are not membrane-bound.
- (C) The “power house” is the mitochondrion, not the peroxisome.
- (D) Vacuoles store materials; they are not the described digestive organelle.

Final Answer: Lysosome — “suicide bag” ⇒ **B**

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

Q6.

Solution

Concept — Nucleotide structure: A nucleotide = nitrogenous base + pentose sugar + phosphate. The base attaches to the sugar (forming a nucleoside) and the phosphate esterifies the sugar.

Step 1 — Identify the true statement: The phosphate is linked to the sugar, and the sugar is linked to the nitrogenous base. This chain (phosphate–sugar–base) is correct.

Why other options are wrong:

- (A) A nucleotide *includes* a phosphate (base + sugar alone is a nucleoside).
- (B) DNA has deoxyribose; RNA has ribose (reversed in the option).
- (C) Thymine is in DNA; uracil is in RNA (reversed).

Final Answer: Phosphate–sugar–base linkage ⇒ **D**

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



Q7.

Solution

Concept — Mitosis vs meiosis: Mitosis is a single division giving two diploid cells; meiosis is two successive divisions (I and II) giving four haploid cells with recombination.

Step 1 — Apply to $2n = 8$: Meiosis halves the chromosome number, so each of the four products has $n = 4$ chromosomes, after two divisions.

Why other options are wrong:

- (B) Describes mitosis (one division, two diploid cells).
- (C) Meiosis does not give diploid products.
- (D) Four haploid cells require *two* divisions, not one.

Final Answer: Two divisions; four haploid ($n = 4$) cells \Rightarrow

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

Q8.

Solution

Concept — Photosynthetic pigments: Chlorophyll *a* is the chief reaction-centre pigment; accessory pigments (chlorophyll *b*, carotenoids) widen the spectrum captured and protect chlorophyll *a*.

Step 1 — Identify the true statement: Accessory pigments absorb wavelengths that chlorophyll *a* does not, transfer the harvested energy to chlorophyll *a*, and protect it from photo-oxidation. Correct.

Why other options are wrong:

- (A) Chlorophyll *a* absorbs in the blue and red regions and *reflects* green.
- (B) The reaction-centre pigment is chlorophyll *a*, not the accessory pigments.
- (D) The action and absorption spectra largely overlap.

Final Answer: Accessory pigments harvest extra wavelengths and protect chlorophyll *a* \Rightarrow

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



Q9.

Solution

Concept — Respiratory quotient: $RQ = \frac{\text{CO}_2 \text{ evolved}}{\text{O}_2 \text{ consumed}}$. For glucose, $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O}$, so $RQ = 6/6 = 1.0$.

Step 1 — Identify substrate with $RQ = 1$: Carbohydrates such as glucose give exactly $RQ = 1.0$.

Why other options are wrong:

- (A) Fats have $RQ \approx 0.7$ (less than 1).
- (C) Proteins have $RQ \approx 0.8-0.9$.
- (D) Organic acids give $RQ > 1$ (e.g. malic acid ≈ 1.33).

Final Answer: Carbohydrates (glucose), $RQ = 1.0 \Rightarrow \boxed{\text{B}}$

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

Q10.

Solution

Concept — Blood and clotting: Plasma (~55% of blood) carries proteins including fibrinogen. Clotting converts soluble fibrinogen to insoluble fibrin.

Step 1 — Identify the true statement: During clotting, fibrinogen is converted to fibrin threads that trap blood cells, forming the clot. Correct.

Why other options are wrong:

- (A) Plasma is ~55% of blood and is mostly water with proteins, not red pigment.
- (B) AB is the universal *recipient* and has *no* anti-A/anti-B antibodies.
- (C) Erythrocytes carry O_2 ; phagocytosis/immunity is by leukocytes.

Final Answer: Fibrinogen \rightarrow fibrin during clotting $\Rightarrow \boxed{\text{D}}$

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



Q11.

Solution

Concept — Endocrine glands and hormones: Thyroid → thyroxine; adrenal cortex → cortisol; pancreatic β -cells → insulin; anterior pituitary → growth hormone (among others).

Step 1 — Match the schematic: 1 (thyroid) → thyroxine, 2 (adrenal cortex) → cortisol, 3 (pancreas β) → insulin, 4 (anterior pituitary) → growth hormone. This is option (A).

Why other options are wrong:

- (B), (C), (D) each scramble at least one gland–hormone pairing (e.g. assigning insulin to the thyroid or thyroxine to the pituitary).

Final Answer: thyroxine, cortisol, insulin, growth hormone ⇒

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

Q12.

Solution

Concept — Anther wall layers: From outside in, the microsporangium wall has epidermis, endothecium, middle layers and tapetum.

Step 1 — Identify the nourishing layer: The innermost layer, the tapetum (W_4), provides nutrition to the developing pollen grains.

Why other options are wrong:

- (A) Epidermis is protective.
- (B) Endothecium aids dehiscence (its fibrous thickenings help the anther split).
- (D) Middle layers are ephemeral and not the nutritive layer.

Final Answer: Tapetum (W_4) nourishes the pollen ⇒

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



Q13.

Solution

Concept — Gametogenesis: Spermatogenesis gives four functional sperm per primary spermatocyte; oogenesis gives one functional ovum and (up to three) polar bodies per primary oocyte.

Step 1 — Identify the true statement: One primary spermatocyte → four sperm; one primary oocyte → one ovum + polar bodies. This is option (B).

Why other options are wrong:

- (A) Reverses the numbers.
- (C) Oogenesis does *not* yield four equal functional gametes.
- (D) Overstates “identical” timing; oogenesis begins before birth and arrests, unlike spermatogenesis.

Final Answer: 4 sperm vs 1 ovum (+ polar bodies) ⇒

[Go Back to Q13](#)

Q14.

Solution

Concept — Test cross of a heterozygote: Crossing $Tt \times tt$ gives gametes T,t (from Tt) and t,t (from tt).

Step 1 — Read the Punnett square: Offspring are Tt, tt, Tt, tt = 2 tall (Tt) : 2 dwarf (tt) = 1 tall : 1 dwarf.

Why other options are wrong:

- (A) 3:1 is the F_2 monohybrid ratio ($Tt \times Tt$), not a test cross.
- (B) “All tall” would result if the tall parent were homozygous TT.
- (C) 1:3 inverts the correct ratio.

Final Answer: 1 tall : 1 dwarf ⇒

[Go Back to Q14](#)



Q15.

Solution

Concept — Properties of the genetic code: The code is a triplet code, degenerate (most amino acids have more than one codon), nearly universal, non-overlapping and comma-less.

Step 1 — Identify the true statement: Option (A) lists triplet, degenerate, (nearly) universal and non-overlapping, comma-less correctly.

Why other options are wrong:

- (B) The code is degenerate, so one amino acid can have several codons.
- (C) The code is non-overlapping.
- (D) The code is nearly universal, not entirely different across kingdoms.

Final Answer: Triplet, degenerate, universal, non-overlapping ⇒

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

Q16.

Solution

Concept — Chemical evolution: The Oparin–Haldane hypothesis proposed that life arose from simple molecules under primitive-Earth conditions.

Step 1 — Identify the experiment: Stanley Miller and Harold Urey passed electric sparks through CH_4 , NH_3 , H_2 and water vapour and obtained amino acids, supporting the Oparin–Haldane hypothesis.

Why other options are wrong:

- (A) Pasteur/Spallanzani worked on biogenesis vs spontaneous generation, not chemical evolution.
- (B) Panspermia and Darwin do not match this apparatus.
- (D) Special creation is not an experimental hypothesis, and Mendel worked on heredity.

Final Answer: Oparin–Haldane; Miller and Urey ⇒

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



Q17.

Solution

Concept — Innate vs acquired, active vs passive immunity: Innate immunity is non-specific and present from birth; acquired immunity is specific with memory. Active immunity is self-made (slow, long-lasting); passive immunity is ready-made antibodies (fast, short-lived).

Step 1 — Identify the true statement: Giving preformed antibodies (e.g. anti-tetanus serum) is passive immunity: immediate but short-lived. Option (B) is correct.

Why other options are wrong:

- (A) Innate immunity is non-specific and lacks memory.
- (C) Vaccination gives *active* immunity (the body makes its own antibodies and memory cells).
- (D) Active immunity is slow to develop but long-lasting, with memory.

Final Answer: Passive immunity = ready-made antibodies, immediate but short-lived \Rightarrow

[Go Back to Q17](#)

Q18.

Solution

Concept — Microbes in human welfare: Methanogens make biogas (mostly methane); *Rhizobium* and mycorrhizae are biofertilizers.

Step 1 — Identify the true statement: *Rhizobium* fixes atmospheric nitrogen in legume root nodules, while mycorrhizal fungi (e.g. *Glomus*) help the plant absorb phosphorus. Option (D) is correct.

Why other options are wrong:

- (A) Methanogens produce *methane*, not oxygen.
- (B) *Rhizobium* is a nitrogen-fixing *bacterium*, not a free-living fungus.
- (C) Mycorrhiza is a beneficial mutualism, not a harmful parasite.

Final Answer: *Rhizobium* fixes N_2 ; mycorrhiza aids P uptake \Rightarrow

[Go Back to Q18](#)



Q19.

Solution

Concept — Features of a cloning vector: A good plasmid vector needs an origin of replication (*ori*), selectable marker(s), and unique restriction site(s) for inserting foreign DNA.

Step 1 — Identify the true statement: The map shows *ori*, amp^R/tet^R markers and unique *EcoRI/BamHI* sites, exactly the features in option (A).

Why other options are wrong:

- (B) Without an *ori* the vector could not replicate.
- (C) A selectable marker is essential to identify transformants.
- (D) Without restriction sites, foreign DNA cannot be inserted.

Final Answer: *ori* + selectable marker + restriction sites \Rightarrow **A**

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

Q20.

Solution

Concept — Ecological pyramids: Pyramids of number and biomass can sometimes be inverted, but the pyramid of energy is *always upright* because energy is lost (as heat) at each transfer (10% law).

Step 1 — Identify the true statement: The pyramid of energy is always upright since usable energy decreases at each higher trophic level. Option (B) is correct.

Why other options are wrong:

- (A) The energy pyramid cannot be inverted.
- (C) The biomass pyramid *can* be inverted (e.g. in a sea with tiny phytoplankton supporting larger zooplankton).
- (D) The pyramid of numbers can be inverted (e.g. a big tree with many insects).

Final Answer: The pyramid of energy is always upright \Rightarrow **B**

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



Answer Key

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

