Reading Comprehension 1

▪ Paragraph: A butterfly begins life as a tiny egg on a leaf. Inside the egg grows a caterpillar, which soon hatches and starts eating the plant around it. After growing quickly, the caterpillar forms a chrysalis, where its body is reorganized into the adult stage. When the transformation is complete, the butterfly emerges, dries its wings, and flies away to feed on nectar and lay new eggs. This repeating sequence is called a life cycle and helps butterflies survive from one generation to the next.

– **Question:** What is the first stage of a butterfly's life cycle?
— Option A: Caterpillar
— Option B: Chrysalis
— Option C: Egg
— Option D: Adult butterfly

— Correct Answer: C

– **Question:** Why does the caterpillar eat so much?
— Option A: To store energy for the chrysalis stage
— Option B: To avoid predators
— Option C: To dry its wings
— Option D: To make nectar

— Correct Answer: A

– **Question:** Where does the butterfly emerge from?
— Option A: An egg
— Option B: A chrysalis
— Option C: A flower
— Option D: A leaf vein

— Correct Answer: B

– **Question:** What do adult butterflies mainly eat?
— Option A: Leaves
— Option B: Nectar
— Option C: Soil
— Option D: Caterpillars

— Correct Answer: B

– **Question:** The term "life cycle" in this paragraph refers to…
— Option A: The length of a butterfly's wings

— Option B: The repeating sequence of stages from egg to adult
— Option C: The plants butterflies visit
— Option D: Seasonal weather changes

— Correct Answer: B

Reading Comprehension 2

▪ Paragraph: Many cities promote recycling to reduce the amount of waste sent to landfills. Recycling involves collecting materials such as paper, glass, metals, and certain plastics, processing them, and turning them into new products. This practice saves natural resources, lowers energy use compared with producing goods from raw materials, and decreases greenhouse-gas emissions. However, contamination—like food scraps mixed with clean paper—can cause entire batches to be discarded, so correct sorting is essential for recycling programs to succeed.

– **Question:** Which material is commonly collected for recycling?
— Option A: Food scraps
— Option B: Metal cans
— Option C: Garden soil
— Option D: Ceramics only

— Correct Answer: B

– **Question:** One main environmental benefit of recycling is…
— Option A: Increasing landfill size
— Option B: Saving natural resources
— Option C: Raising energy consumption
— Option D: Producing more raw materials

— Correct Answer: B

– **Question:** What problem can contamination cause?
— Option A: Lower energy use
— Option B: Discarding whole recycling batches
— Option C: Higher paper quality
— Option D: Faster processing times

— Correct Answer: B

– **Question:** Which of these actions helps recycling succeed?
— Option A: Mixing glass with food waste
— Option B: Correctly sorting materials

— Option C: Burning plastic bottles
— Option D: Burying metals in soil

— Correct Answer: B

– **Question:** Compared with making products from raw resources, recycling usually…
— Option A: Requires more energy
— Option B: Uses less energy
— Option C: Generates no emissions at all
— Option D: Needs no processing facilities

— Correct Answer: B

Reading Comprehension 3

▪ Paragraph: Photosynthesis in most crops follows the C_3 pathway, where the enzyme RuBisCO fixes carbon dioxide directly inside mesophyll chloroplasts. Under intense sunlight and arid air, RuBisCO mistakenly binds oxygen, causing photorespiration that wastes energy and water. C_4 plants such as maize and sugarcane add an extra biochemical circuit: atmospheric CO_2 is first combined with phosphoenol-pyruvate in outer mesophyll cells, producing four-carbon malate that is transported to bundle-sheath cells. Here CO_2 is released at high local concentration for the Calvin cycle, while the three-carbon residue returns to repeat the loop. By concentrating CO_2 near RuBisCO and allowing stomata to stay partially closed, C_4 metabolism cuts water loss, limits photorespiration, and boosts yield in hot, tropical environments.

– **Question:** Which enzyme fixes CO_2 in the C3 pathway?
— Option A: ATP synthase
— Option B: RuBisCO
— Option C: Chlorophyll
— Option D: Amylase

— Correct Answer: B

– **Question:** The term "bundle-sheath cells" appears in…
— Option A: C3 plants only
— Option B: C4 plants only
— Option C: Both C3 and C4 plants
— Option D: Neither plant type

— Correct Answer: C

– **Question:** Why do C4 plants waste less water?
— Option A: They open stomata at night only
— Option B: They store CO_2 indefinitely
— Option C: They reduce photorespiration in hot climates
— Option D: They have no chloroplasts in mesophyll cells

— Correct Answer: C

– **Question:** Maize outperforms wheat in the tropics mainly because maize…
— Option A: Has deeper roots
— Option B: Uses the C4 pathway
— Option C: Contains more chlorophyll B
— Option D: Fixes nitrogen from air

— Correct Answer: B

– **Question:** Photorespiration is best described as…
— Option A: Light-driven sugar synthesis
— Option B: Loss of fixed carbon as CO_2
— Option C: Uptake of oxygen at night
— Option D: Breakdown of chlorophyll pigments

— Correct Answer: B

Reading Comprehension 4

• Paragraph: Earth's outer shell, the lithosphere, is broken into a dozen major tectonic plates that float on the softer, slowly convecting asthenosphere. At mid-ocean ridges those plates diverge; magma wells upward, solidifies, and pushes the seafloor aside, creating symmetrical magnetic stripes that record field reversals. Where plates collide, density differences force the denser slab downward in a subduction zone, producing deep trenches, explosive arc volcanoes, and earthquakes that can trigger tsunamis. Elsewhere, transform boundaries such as California's San Andreas Fault accommodate lateral motion; accumulated strain is released suddenly, generating powerful quakes felt hundreds of kilometres away. Plate-tectonic theory therefore synthesises ocean-floor mapping, seismology, and mountain-building into one coherent model of planetary dynamics.

– **Question:** New oceanic crust forms mainly at…
— Option A: Subduction zones
— Option B: Mid-ocean ridges
— Option C: Transform faults
— Option D: Hot desert basins

— Correct Answer: B

– **Question:** A convergent boundary typically produces…
— Option A: Rift valleys
— Option B: Deep trenches and volcanic arcs
— Option C: Horizontal fault motion only
— Option D: Quiet seismic zones

— Correct Answer: B

– **Question:** Which U.S. fault is cited as a transform boundary?
— Option A: New Madrid
— Option B: Denali
— Option C: San Andreas
— Option D: Cascadia

— Correct Answer: C

– **Question:** Subduction involves one plate…
— Option A: Sliding past another vertically
— Option B: Moving upward onto another
— Option C: Bending and descending beneath another
— Option D: Breaking into smaller microplates exclusively

— Correct Answer: C

– **Question:** Plate tectonics helps scientists explain…
— Option A: The composition of Earth's atmosphere
— Option B: Locations of earthquakes and volcanoes
— Option C: Lunar crater formation
— Option D: Magnetic field reversals only

— Correct Answer: B

Reading Comprehension 5

▪ Paragraph: CRISPR-Cas9 genome editing originated from a bacterial defence that chops invading viral DNA. In the laboratory, researchers program the Cas9 nuclease with a 20-base guide RNA complementary to a target gene adjacent to a short PAM sequence. Cas9 induces a double-strand break; the cell then repairs it either through error-prone non-homologous end joining—often knocking out the gene—or through precise homology-directed repair if a donor template is supplied. Because the system is modular, multiplexed guides can edit multiple loci simultaneously, enabling disease-model mice,

drought-tolerant crops, and potential human gene therapies. Yet concerns about off-target cuts, germ-line modification, and gene-drive applications have prompted international ethical frameworks and moratoria on certain uses.

– Question: CRISPR-Cas9 originates from…
— Option A: Viruses
— Option B: Fungi
— Option C: Bacteria
— Option D: Human stem cells

— Correct Answer: C

– Question: What directs Cas9 to a specific DNA site?
— Option A: A protein tag
— Option B: A short RNA guide
— Option C: A lipid envelope
— Option D: A magnetic field

— Correct Answer: B

– Question: The cell's error-prone repair pathway is called…
— Option A: Homology-directed repair
— Option B: Non-homologous end joining
— Option C: Base excision repair
— Option D: Photoreactivation

— Correct Answer: B

– Question: Supplying a repair template enables…
— Option A: Random mutations only
— Option B: Precise gene edits
— Option C: Protein translation
— Option D: RNA splicing

— Correct Answer: B

– Question: Which topic is most debated about CRISPR?
— Option A: Its cost in agriculture
— Option B: Ethical concerns in human therapy
— Option C: The colour of edited plants
— Option D: Recycling DNA waste

— Correct Answer: B

Reading Comprehension 6

▪ Paragraph: Quantum entanglement links two or more particles so that measuring one instantly determines the properties of its partner, a phenomenon that defies classical locality but is permitted by the mathematics of quantum theory. Experiments using entangled photons have closed detection and locality loopholes, repeatedly violating Bell's inequalities and reinforcing the non-classical correlations. Entanglement enables quantum-key distribution, teleportation of qubit states, and the creation of cluster states for measurement-based quantum computing. However, decoherence—interaction with the environment—rapidly destroys entanglement, making error-correction codes and cryogenic hardware critical for scalable devices. Harnessing entanglement could revolutionize fields from cryptography to complex-system simulation.

– Question: Entanglement implies that two particles…
— Option A: Occupy the same space always
— Option B: Share correlated states even when separated
— Option C: Lose all measurable properties
— Option D: Repel each other strongly

— Correct Answer: B

– Question: What test is used to verify entanglement experimentally?
— Option A: Rutherford scattering
— Option B: Bell's inequalities
— Option C: Ohm's law
— Option D: Doppler shift

— Correct Answer: B

– Question: Einstein's phrase for entanglement was…
— Option A: Cosmic ballet
— Option B: Spooky action at a distance
— Option C: Relativistic drag
— Option D: Quantum vacuum

— Correct Answer: B

– Question: A qubit differs from a classical bit because a qubit can…
— Option A: Store larger files
— Option B: Be both 0 and 1 simultaneously
— Option C: Consume no energy
— Option D: Function only at high temperatures

— Correct Answer: B

– **Question:** One practical use of entanglement today is…
— Option A: Quantum cryptography
— Option B: Petrol refining
— Option C: Photosynthesis enhancement
— Option D: Mechanical clock timing

— Correct Answer: A

Reading Comprehension 7

▪ Paragraph: Climate feedback loops modify the planet's response to an initial temperature perturbation. When Arctic sea ice melts, reflective white surfaces give way to dark ocean that absorbs additional solar energy, amplifying warming in a positive feedback known as the ice-albedo effect. Water-vapour feedback further strengthens warming because warmer air holds more greenhouse vapour. In contrast, certain low-level marine stratocumulus clouds reflect incoming radiation, acting as negative feedback. Scientists employ coupled atmosphere-ocean models and palaeoclimate evidence to estimate the net gain, yet cloud microphysics, aerosol seeding, and potential rapid ice-sheet collapse remain large sources of uncertainty in projecting twenty-first-century climate pathways.

– **Question:** A positive climate feedback…
— Option A: Reduces the initial temperature change
— Option B: Amplifies the initial temperature change
— Option C: Has no effect on temperature
— Option D: Always cools the planet

— Correct Answer: B

– **Question:** Melting sea ice leads to further warming because…
— Option A: Ice releases greenhouse gases
— Option B: Darker water absorbs more sunlight
— Option C: Oceans emit sulphur compounds
— Option D: Polar bears migrate south

— Correct Answer: B

– **Question:** Certain low-level clouds can serve as…
— Option A: Positive feedback only
— Option B: Negative feedback by reflecting light
— Option C: Heat sources
— Option D: Indicators of volcanic eruptions

— Correct Answer: B

– Question: The phrase "largest uncertainties" refers to…
— Option A: Weather forecasts next week
— Option B: Predicting the net effect of feedbacks
— Option C: Calculating Earth's current radius
— Option D: Measuring sea-level pressure today

— Correct Answer: B

– Question: Which of the following is not a feedback mechanism?
— Option A: Ice-albedo effect
— Option B: Greenhouse gas emissions from human industry (trick)
— Option C: Water-vapour amplification
— Option D: Cloud-albedo changes

— Correct Answer: B

Reading Comprehension 8

▪ Paragraph: In machine learning, overfitting arises when a model captures chance irregularities in the training data rather than the underlying functional relationship. Symptoms include a widening gap where training loss keeps falling while validation loss turns upward. Counter-measures start with K-fold cross-validation to assess generalisation, continue with regularisation terms such as L_2 weight decay or L_1 sparsity, and often incorporate dropout layers or early-stopping callbacks. Expanding the dataset through augmentation or new samples reshapes the input distribution and improves robustness. Ultimately, striking the bias-variance balance is vital for deploying models that perform reliably on unseen, real-world inputs.

– Question: Overfitting is best described as a model that…
— Option A: Under-represents the training data
— Option B: Memorizes noise instead of true patterns
— Option C: Generalizes well
— Option D: Has zero parameters

— Correct Answer: B

– Question: Which practice helps detect overfitting?
— Option A: Ignoring validation data
— Option B: Tracking training-validation error gap
— Option C: Using only one large epoch
— Option D: Scaling inputs randomly after training

— Correct Answer: B

– **Question:** L2 weight decay is a form of…
— Option A: Data augmentation
— Option B: Regularization
— Option C: Gradient explosion
— Option D: Feature scaling

— Correct Answer: B

– **Question:** Gathering more varied data generally…
— Option A: Increases overfitting
— Option B: Decreases model capacity
— Option C: Improves generalization
— Option D: Lowers sample diversity

— Correct Answer: C

– **Question:** A sign of overfitting during training is…
— Option A: Validation loss decreasing steadily
— Option B: Training loss plummeting while validation loss rises (trick)
— Option C: Equal losses on both sets
— Option D: High bias and low variance

— Correct Answer: B

Reading Comprehension 9

▪ Paragraph: Bayesian inference applies Bayes' theorem, *posterior ∝ likelihood × prior*, to update the plausibility of hypotheses when new data arrive. A doctor estimating the chance of a disease starts with prevalence (the prior) and multiplies it by the likelihood provided by a patient's test result; the normalised product yields the posterior probability, guiding treatment decisions. For complex hierarchical models with thousands of parameters, closed-form solutions are rare, so algorithms such as Markov-chain Monte Carlo draw samples that approximate the posterior, while variational inference converts the task into an optimisation of a simpler distribution. These techniques underpin spam filters, A/B-testing, and autonomous-vehicle sensor fusion.

– **Question:** The initial belief in Bayesian inference is called the…
— Option A: Likelihood
— Option B: Prior

— Option C: Posterior
— Option D: Evidence

— Correct Answer: B

– **Question:** Posterior probability combines prior and…
— Option A: Random noise
— Option B: Likelihood
— Option C: Gradient descent
— Option D: Hyperparameters

— Correct Answer: B

– **Question:** Bayesian methods are useful in autonomous vehicles for…
— Option A: Updating perception with new sensor data
— Option B: Designing fuel injectors
— Option C: Cooling the engine
— Option D: Painting car bodies

— Correct Answer: A

– **Question:** Exact posterior calculation may be impossible because…
— Option A: Data are always noisy
— Option B: Models can be mathematically complex
— Option C: Priors cannot be chosen
— Option D: Probability is subjective

— Correct Answer: B

– **Question:** Markov-chain Monte Carlo is primarily an…
— Option A: Optimization algorithm
— Option B: Approximation technique for posteriors
— Option C: Encryption method
— Option D: Image filter

— Correct Answer: B

Reading Comprehension 10

• Paragraph: Gravitational waves—minute ripples in spacetime—are generated whenever massive bodies accelerate asymmetrically, with the strongest signals arising from binary black-hole or neutron-star mergers. As they propagate, the waves alternately stretch and squeeze distances by less than one-ten-thousandth the width of a proton over four-kilometre interferometer arms. The Laser Interferometer Gravitational-Wave Observatory (LIGO) and

its European partner Virgo measure this distortion by comparing the phase of split laser beams. The first detection in 2015 validated general relativity and inaugurated multi-messenger astronomy; later events combined gravitational-wave data with gamma-ray bursts and optical kilonovae, revealing how heavy elements such as gold are forged in cosmic collisions.

– Question: Gravitational waves were first directly detected in…
— Option A: 1915
— Option B: 1969
— Option C: 2015
— Option D: 2025

— Correct Answer: C

– Question: Which instrument detected the waves?
— Option A: Hubble Space Telescope
— Option B: CERN's Large Hadron Collider
— Option C: LIGO
— Option D: Voyager 1

— Correct Answer: C

– Question: Gravitational waves arise when…
— Option A: A star shines steadily
— Option B: Masses accelerate, like merging black holes
— Option C: Planets align in a straight line
— Option D: Light passes through a prism

— Correct Answer: B

– Question: According to Einstein, these waves are ripples in…
— Option A: Magnetic fields
— Option B: Spacetime
— Option C: Solar wind
— Option D: Dark matter halos

— Correct Answer: B

– Question: A key advantage of gravitational-wave astronomy is that it…
— Option A: Uses no electricity
— Option B: Reveals events invisible to light-based telescopes
— Option C: Replaces all electromagnetic observations
— Option D: Eliminates scientific uncertainty

— Correct Answer: B