GATE 2026 XL Question Paper with Solutions

Time Allowed :3 Hour	Maximum Marks :100	Total Questions :65

General Instructions

Please read the following instructions carefully:

1. This question paper is divided into three sections:
   - **General Aptitude (GA):** 10 questions (5 questions × 1 mark + 5 questions × 2 marks) for a total of 15 marks.
   - **Environmental Science and Engineering + Engineering Mathematics:**
     - **Part A (Mandatory):** 36 questions (1 questions × 1 mark + 19 questions × 2 marks) for a total of 55 marks.
     - **Part B (Section 1):** Candidates can choose either Part B1 (Surveying and Mapping) or Part B2 (Section 2). Each part contains 16 questions (8 questions × 1 mark + 11 questions × 2 marks) for a total of 30 marks.
2. The total number of questions is **65**, carrying a maximum of **100 marks**.
3. The duration of the exam is **3 hours**.
4. Marking scheme:
   - For 1-mark MCQs, $\frac{1}{3}$ mark will be deducted for every incorrect response.
   - For 2-mark MCQs, $\frac{2}{3}$ mark will be deducted for every incorrect response.
   - No negative marking for numerical answer type (NAT) questions.
   - No marks will be awarded for unanswered questions.
5. Ensure you attempt questions only from the optional section (Part B1 or Part B2) you have selected.
6. Follow the instructions provided during the exam for submitting your answers.

1. Which of the following amino acids is essential in human diet?

(A) Alanine
(B) Glycine
(C) Valine
(D) Glutamic acid

Correct Answer: (C) Valine

Solution:

Step 1: Understanding essential amino acids.
Essential amino acids are those amino acids which cannot be synthesized by the human body in sufficient amounts. Therefore, they must be obtained directly from the diet through food sources such as proteins.

Step 2: Classification of the given options.
(A) Alanine: Alanine is a non-essential amino acid because it can be synthesized in the human body.
(B) Glycine: Glycine is also a non-essential amino acid as it is produced by the body.
(C) Valine: Valine is an essential amino acid. It cannot be synthesized by humans and must be obtained from dietary proteins.
(D) Glutamic acid: Glutamic acid is a non-essential amino acid synthesized in the body.

Step 3: Conclusion.
Among the given options, only **Valine** is an essential amino acid required in the human diet.

Quick Tip

Remember: Essential amino acids include Valine, Leucine, Isoleucine, Lysine, Methionine, Threonine, Tryptophan, Histidine, and Phenylalanine.

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2. Which phase of the cell cycle is known as the resting phase?

(A) G_1 phase
(B) S phase
(C) G_2 phase
(D) M phase

Correct Answer: (A) G_1 phase

Solution:

Step 1: Understanding the cell cycle.
The cell cycle consists of Interphase (G_1, S, and G_2 phases) and the M phase. Interphase is the longest phase where the cell grows and prepares for division.

Step 2: Identifying the resting phase.
G_1 phase is commonly referred to as the resting phase because the cell performs normal metabolic activities, grows in size, and prepares the necessary components for DNA synthesis. No DNA replication occurs during this phase.

Step 3: Analysis of other phases.
(B) S phase: DNA synthesis and replication occur.
(C) G_2 phase: The cell prepares for mitosis by synthesizing proteins and organelles.
(D) M phase: Actual cell division (mitosis) takes place.

Step 4: Conclusion.
Since the G_1 phase involves normal cellular activity without DNA replication or division, it is known as the resting phase of the cell cycle.

Quick Tip

The G_1 phase is called the resting phase because the cell is metabolically active but not dividing or replicating DNA.

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3. Which of the following is a stop codon?

(A) AUG
(B) UGG
(C) UGA
(D) UAC

Correct Answer: (C) UGA

Solution:

Step 1: Understanding codons.
A codon is a sequence of three nucleotides present on mRNA that codes for a specific amino acid or signals the termination of protein synthesis. Codons are read during the process of translation.

Step 2: Identifying stop codons.
In the genetic code, there are three stop codons that do not code for any amino acid. These stop codons signal the end of translation. The three stop codons are:
UAA, UAG, and UGA.

Step 3: Analysis of the given options.
(A) AUG: This is the start codon and codes for the amino acid Methionine.
(B) UGG: This codon codes for the amino acid Tryptophan.
(C) UGA: This is a stop codon and signals termination of protein synthesis.
(D) UAC: This codon codes for the amino acid Tyrosine.

Step 4: Conclusion.
Among the given options, **UGA** is the correct stop codon that terminates translation.

Quick Tip

Remember the mnemonic for stop codons: **U Are Annoying** — UAA, UAG, and UGA.

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4. The process of conversion of nitrogen into ammonia by bacteria is called:

(A) Nitrification
(B) Denitrification
(C) Nitrogen fixation
(D) Ammonification

Correct Answer: (C) Nitrogen fixation

Solution:

Step 1: Understanding the nitrogen cycle.
Nitrogen is an essential element for living organisms, but atmospheric nitrogen (N_2) cannot be directly used by plants and animals. It must first be converted into usable forms such as ammonia or nitrates through various biological processes collectively known as the nitrogen cycle.

Step 2: Understanding nitrogen fixation.
Nitrogen fixation is the process by which atmospheric nitrogen (N_2) is converted into ammonia (NH_3) by nitrogen-fixing bacteria such as *Rhizobium*, *Azotobacter*, and cyanobacteria. This process makes nitrogen available to plants.

Step 3: Analysis of the given options.
(A) Nitrification: This is the conversion of ammonia into nitrites and nitrates by nitrifying bacteria.
(B) Denitrification: This is the conversion of nitrates back into atmospheric nitrogen.
(C) Nitrogen fixation: Correct — it converts atmospheric nitrogen into ammonia with the help of bacteria.
(D) Ammonification: This is the conversion of organic nitrogen into ammonia during decomposition.

Step 4: Conclusion.
The conversion of nitrogen into ammonia by bacteria is correctly called **Nitrogen fixation**.

Quick Tip

Nitrogen fixation is the only process that directly converts atmospheric nitrogen (N_2) into a biologically usable form.

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5. Which pyramid is always upright in an ecosystem?

(A) Pyramid of energy
(B) Pyramid of biomass
(C) Pyramid of numbers
(D) All of the above

Correct Answer: (A) Pyramid of energy

Solution:

Step 1: Understanding ecological pyramids.
Ecological pyramids represent the relationship between organisms at different trophic levels in an ecosystem. These pyramids can be of numbers, biomass, or energy.

Step 2: Understanding the pyramid of energy.
The pyramid of energy shows the flow of energy from one trophic level to the next. Since energy is lost at every trophic level (mainly as heat), the amount of energy always decreases as we move up the food chain.

Step 3: Analysis of different pyramids.
Pyramid of numbers: May be upright or inverted depending on the ecosystem.
Pyramid of biomass: Can be inverted in aquatic ecosystems.
Pyramid of energy: Always upright because energy decreases at each successive trophic level according to the second law of thermodynamics.

Step 4: Conclusion.
The pyramid of energy is always upright in all ecosystems because energy flow is unidirectional and decreases at each trophic level.

Quick Tip

Energy pyramids are always upright because only about 10% of energy is transferred from one trophic level to the next.

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6. The DNA double helix is stabilized primarily by:

(A) Covalent bonds
(B) Hydrogen bonds
(C) Ionic bonds
(D) Van der Waals forces

Correct Answer: (B) Hydrogen bonds

Solution:

Step 1: Understanding the structure of DNA.
DNA is composed of two antiparallel polynucleotide strands forming a double helix structure. Each strand has a sugar-phosphate backbone and nitrogenous bases projecting inward.

Step 2: Identifying the forces holding the two strands together.
The two DNA strands are held together by hydrogen bonds formed between complementary nitrogenous bases — adenine pairs with thymine via two hydrogen bonds, and guanine pairs with cytosine via three hydrogen bonds.

Step 3: Analysis of the given options.
(A) Covalent bonds: These bonds hold nucleotides together within a single strand, not between the two strands.
(B) Hydrogen bonds: Correct — hydrogen bonds between complementary bases stabilize the DNA double helix.
(C) Ionic bonds: These do not play a major role in stabilizing DNA structure.
(D) Van der Waals forces: They contribute slightly but are not the primary stabilizing force.

Step 4: Conclusion.
The DNA double helix is primarily stabilized by **hydrogen bonds** between complementary base pairs.

Quick Tip

Hydrogen bonds provide stability to DNA while still allowing strand separation during replication and transcription.

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7. Which enzyme is used to join two DNA fragments in genetic engineering?

(A) Restriction endonuclease
(B) DNA polymerase

(C) RNA polymerase
(D) DNA ligase

Correct Answer: (D) DNA ligase

Solution:

Step 1: Understanding genetic engineering.
Genetic engineering involves cutting DNA at specific sites and then joining desired DNA fragments to form recombinant DNA. This process requires specialized enzymes.

Step 2: Role of DNA ligase.
DNA ligase is an enzyme that joins DNA fragments by forming phosphodiester bonds between adjacent nucleotides. It seals the sugar-phosphate backbone, making the DNA continuous.

Step 3: Analysis of the given options.
(A) Restriction endonuclease: These enzymes cut DNA at specific recognition sites.
(B) DNA polymerase: This enzyme synthesizes new DNA strands but does not join fragments.
(C) RNA polymerase: It synthesizes RNA from a DNA template.
(D) DNA ligase: Correct — it joins two DNA fragments by forming phosphodiester bonds.

Step 4: Conclusion.
The enzyme used to join two DNA fragments in genetic engineering is **DNA ligase**.

Quick Tip

Restriction enzymes cut DNA, while DNA ligase acts as the "molecular glue" to join DNA fragments.
