GATE 2026 BT 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.

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1. Which of the following bonds is responsible for maintaining the secondary structure of proteins?

(A) Peptide bond
(B) Hydrogen bond
(C) Disulfide bond
(D) Ionic bond

Correct Answer: (B) Hydrogen bond

Solution:

Step 1: Understanding the Concept:
The secondary structure of a protein refers to the local spatial arrangement of its main-chain atoms, without regard to the conformation of its side chains or its relationship to other segments.
The most common types of secondary structures are the α-helix and the β-pleated sheet.

Step 2: Detailed Explanation:
The stability of these secondary structures is primarily due to hydrogen bonds formed between the carbonyl oxygen ($C = O$) of one peptide bond and the amide hydrogen ($N - H$) of another peptide bond.
- **Peptide bonds** (Option A) are covalent bonds that define the primary structure (the sequence of amino acids).
- **Disulfide bonds** (Option C) and **Ionic bonds** (Option D) are primarily involved in stabilizing the tertiary and quaternary structures of proteins.
In an α-helix, the hydrogen bond forms between the n^{th} and the $(n+4)^{th}$ amino acid residue.

Step 3: Final Answer:
Therefore, the hydrogen bond is the key interaction responsible for maintaining the secondary structure of proteins.

Quick Tip

Remember: Primary structure = Covalent (Peptide) bonds; Secondary structure = Hydrogen bonds; Tertiary structure = Hydrophobic, Ionic, Disulfide, and van der Waals interactions.

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2. Which microorganism is commonly used for industrial production of ethanol?

(A) Escherichia coli
(B) Bacillus subtilis
(C) Saccharomyces cerevisiae
(D) Lactobacillus

Correct Answer: (C) Saccharomyces cerevisiae

Solution:

Step 1: Understanding the Concept:
Ethanol production at an industrial scale is achieved through the fermentation of sugars (like glucose or molasses) by specific microorganisms under anaerobic conditions.

Step 2: Detailed Explanation:
Saccharomyces cerevisiae, commonly known as brewer's yeast or baker's yeast, is the organism of choice for industrial ethanol production.
It possesses several desirable traits:
1. High fermentation rate and efficiency.
2. High tolerance to ethanol concentrations (up to $12 - 15\%$).
3. Ability to grow at low pH, which reduces the risk of bacterial contamination.
- **Escherichia coli** (Option A) is a model bacterium used in molecular biology.
- **Bacillus subtilis** (Option B) is used for enzyme and antibiotic production.
- **Lactobacillus** (Option D) is used for lactic acid production (yogurt making).

Step 3: Final Answer:
Saccharomyces cerevisiae is the most common microorganism used globally for industrial-scale ethanol fermentation.

Quick Tip

The conversion of glucose to ethanol by yeast follows the stoichiometry: $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$.

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3. Which of the following is a recessive genetic disorder?

(A) Huntington's disease
(B) Sickle cell anemia
(C) Achondroplasia
(D) Marfan syndrome

Correct Answer: (B) Sickle cell anemia

Solution:

Step 1: Understanding the Concept:
Genetic disorders are classified as dominant or recessive based on whether one or two copies of the mutated gene are required for the disease to manifest.

Step 2: Detailed Explanation:
- **Sickle cell anemia** is an autosomal recessive disorder. This means an individual must inherit two copies of the mutated hemoglobin gene (HbS) to have the disease. Carriers (HbAS) usually do not show symptoms.
- **Huntington's disease** (Option A) is an autosomal dominant neurodegenerative disorder.
- **Achondroplasia** (Option C), a common form of dwarfism, is an autosomal dominant condition.
- **Marfan syndrome** (Option D), which affects connective tissue, is also an autosomal domi-

nant disorder.

Step 3: Final Answer:
Sickle cell anemia is the recessive disorder among the choices provided.

Quick Tip

If a question lists common genetic diseases, remember that Sickle Cell, Cystic Fibrosis, and Phenylketonuria (PKU) are classic examples of autosomal recessive inheritance.

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4. Which parameter is most commonly controlled in a bioreactor?

(A) Light intensity
(B) pH
(C) Pressure
(D) Sound

Correct Answer: (B) pH

Solution:

Step 1: Understanding the Concept:
A bioreactor provides a controlled environment for the growth of cells or microorganisms. Maintaining optimal physicochemical conditions is vital for cell health and product formation.

Step 2: Detailed Explanation:
The **pH** is one of the most critical parameters monitored and controlled in almost all industrial fermentations.
As microorganisms grow, they consume nutrients and release metabolic by-products (like organic acids), which can significantly shift the pH of the medium.
If the pH deviates from the optimum, enzyme activity inside the cells can drop, leading to decreased growth or cell death.
Bioreactors use automated systems to add acid or base to keep the pH at a specific set point.
- **Light intensity** (Option A) is only controlled for photobioreactors (e.g., algae).
- **Pressure** (Option C) is monitored but not as dynamically controlled for biological optimization as pH.

Step 3: Final Answer:
Among the given options, pH is the most universally controlled parameter in bioreactor operations.

Quick Tip

Temperature and pH are the "fundamental two" parameters. Dissolved Oxygen (DO) is the third most critical for aerobic processes.

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5. Which enzyme is responsible for synthesis of RNA from a DNA template?

(A) DNA polymerase
(B) RNA polymerase
(C) Reverse transcriptase
(D) DNA ligase

Correct Answer: (B) RNA polymerase

Solution:

Step 1: Understanding the Concept:
The process of creating an RNA copy from a DNA sequence is known as **transcription**. This is a fundamental part of the central dogma of molecular biology.

Step 2: Detailed Explanation:
- **RNA polymerase** is the enzyme that binds to a DNA promoter and synthesizes a complementary RNA strand (mRNA, tRNA, or rRNA) by adding ribonucleotides.
- **DNA polymerase** (Option A) synthesizes DNA from a DNA template during replication.
- **Reverse transcriptase** (Option C) synthesizes DNA from an RNA template (the reverse of the standard process).
- **DNA ligase** (Option D) is an enzyme that "glues" DNA fragments together.

Step 3: Final Answer:
RNA polymerase is the enzyme specifically responsible for synthesizing RNA using a DNA template.

Quick Tip

Transcription (DNA to RNA) = RNA Polymerase.
Replication (DNA to DNA) = DNA Polymerase.
Translation (RNA to Protein) = Ribosomes.

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6. Which antibody class is most abundant in human serum?

(A) IgA
(B) IgD
(C) IgE
(D) IgG

Correct Answer: (D) IgG

Solution:

Step 1: Understanding the Concept:
In humans, there are five classes of immunoglobulins (antibodies): IgA, IgD, IgE, IgG, and IgM. They differ in their biological properties, locations, and concentrations.

Step 2: Detailed Explanation:
IgG is the most prevalent antibody class in the blood and tissue fluids, making up about $75 - 80\%$ of the total serum antibodies.
It is highly significant because it can cross the placenta to provide passive immunity to the fetus.
- **IgA** (Option A) is the most abundant antibody in secretions (breast milk, saliva, mucus).
- **IgM** is the first antibody produced during an initial immune response.
- **IgE** (Option C) is involved in allergic reactions.

Step 3: Final Answer:
IgG is the antibody class that exists in the highest concentration in human serum.

Quick Tip

Remember the order of abundance in serum using the acronym: **GAMED** (IgG > IgA > IgM > IgD > IgE).

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7. The most commonly used technique for separation of proteins is:

(A) Centrifugation
(B) Chromatography
(C) Filtration
(D) Precipitation

Correct Answer: (B) Chromatography

Solution:

Step 1: Understanding the Concept:
Downstream processing aims to isolate a target protein from a complex mixture of cells, nutrients, and other proteins. Separation techniques are chosen based on resolution and throughput.

Step 2: Detailed Explanation:
Chromatography is considered the "workhorse" of protein purification.
It allows for high-resolution separation based on various physical and chemical properties such as:
1. **Charge** (Ion-exchange chromatography).
2. **Size** (Size-exclusion chromatography).
3. **Hydrophobicity** (Hydrophobic interaction chromatography).
4. **Binding specificity** (Affinity chromatography).
- **Centrifugation** (Option A) and **Filtration** (Option C) are typically used for "clarification" (separating cells from liquid) rather than separating one specific protein from another.
- **Precipitation** (Option D) is used for bulk concentration but lacks the resolution of chromatography.

Step 3: Final Answer:
Chromatography is the most widely utilized and effective technique for the specific separation and purification of proteins.

Quick Tip

Affinity chromatography is the most specific type of chromatography because it relies on unique biological interactions like antibody-antigen binding.
