

# Sample Questions - Biothon

## Subject Fundamental Question

1. In a eukaryotic cell, which organelle is responsible for synthesizing proteins?

- a) Mitochondria
- b) Golgi apparatus
- c) Endoplasmic reticulum
- d) Ribosomes**

2. Arrange the following stages of mitosis in the correct order:

- a) Metaphase, Telophase, Prophase, Anaphase
- b) Prophase, Metaphase, Anaphase, Telophase**
- c) Telophase, Anaphase, Prophase, Metaphase
- d) Anaphase, Telophase, Metaphase, Prophase

3. Which of the following best describes the function of the stomata in plants?

- a) Absorption of water and minerals
- b) Gas exchange**
- c) Photosynthesis
- d) Storage of starch

4. Which of the following correctly represents the cellular respiration equation?

- a) **Glucose + Oxygen → Carbon dioxide + Water + Energy**
- b) Carbon dioxide + Water + Energy → Glucose + Oxygen
- c) Oxygen + Water → Glucose + Carbon dioxide + Energy
- d) Glucose + Carbon dioxide + Energy → Oxygen + Water

5. What is the primary function of DNA polymerase during DNA replication?

- a) Unwinding the DNA double helix
- b) **Adding nucleotides to the growing DNA strand**
- c) Proofreading the newly synthesized DNA strand
- d) Initiating the replication process

### On-site Learning Question

6. CRISPR-Cas9 is a revolutionary genome editing tool derived from bacterial defense systems against viruses. Cas9, an RNA-guided enzyme, is used to cut DNA at specific target sequences determined by guide RNA molecules. This precise editing capability has wide-ranging applications in genetics, biotechnology, and medicine.

Referring to the provided material on CRISPR-Cas9 technology, what is the primary function of Cas9 in the system?

- a) Initiating DNA replication
- b) Repairing damaged DNA
- c) **Cutting DNA at specific target sequences**

d) Synthesizing RNA molecules

7. Phylogenetic trees depict the evolutionary relationships between species or groups of organisms. They are constructed based on shared characteristics or traits among organisms, aiming to minimize the number of evolutionary changes needed to explain the observed patterns of trait distribution among taxa.

Referring to the provided material on phylogenetic trees, what principle guides the construction of these trees?

a) Natural selection

**b) Parsimony**

c) Genetic drift

d) Convergent evolution

8. Gel electrophoresis is a technique used to separate DNA molecules based on their size and charge. In gel electrophoresis, DNA samples are loaded into wells in a gel matrix and subjected to an electric field. Negatively charged DNA molecules migrate towards the positive electrode, with smaller fragments moving faster through the gel than larger fragments.

Referring to the provided material on gel electrophoresis, which DNA fragments will migrate the farthest distance in a gel electrophoresis experiment?

a) Large fragments

**b) Small fragments**

c) Fragments with a high positive charge

d) Fragments with a high negative charge

9. Recombinant DNA technology involves the manipulation of DNA molecules to create new genetic combinations. One important tool in recombinant DNA technology is restriction enzymes, which recognize specific DNA sequences and cleave the DNA at those sites. Another key component is DNA ligase, which catalyzes the joining of DNA fragments with complementary ends. Together, these enzymes enable the construction of recombinant DNA molecules with desired genetic sequences.

Using the provided material on recombinant DNA technology, how does DNA ligase contribute to the creation of recombinant DNA molecules?

- a) DNA ligase recognizes specific DNA sequences and cleaves the DNA.
- b) DNA ligase facilitates the insertion of foreign DNA into host organisms.
- c) **DNA ligase catalyzes the joining of DNA fragments with complementary ends.**
- d) DNA ligase amplifies specific DNA sequences through PCR.

10. Cellular respiration is the process by which cells generate energy in the form of ATP from the breakdown of glucose and other organic molecules. It occurs in multiple stages, including glycolysis, the citric acid cycle, and oxidative phosphorylation. Glycolysis, the first stage of cellular respiration, takes place in the cytoplasm and produces ATP and pyruvate molecules.

Referring to the provided material on cellular respiration, in which cellular compartment does glycolysis occur?

- a) Mitochondria
- b) Nucleus

- c) Cytoplasm
- d) Endoplasmic reticulum

**Subject Advanced Question**

11. Which of the following statements accurately describes the role of microRNAs (miRNAs) in gene regulation?

- a) miRNAs directly bind to DNA promoters to enhance transcription.
- b) miRNAs function by cleaving mRNA transcripts to prevent translation.
- c) **miRNAs inhibit gene expression by promoting mRNA degradation or inhibiting translation.**
- d) miRNAs are involved in the splicing of pre-mRNA to produce mature mRNA.

12. Which of the following cellular processes requires the participation of molecular chaperones?

- a) DNA replication
- b) **Protein folding**
- c) mRNA transcription
- d) Ribosomal assembly

13. A researcher is studying the function of telomeres in cellular senescence. Which of the following statements best describes the role of telomeres in this process?

- a) Telomeres protect the ends of chromosomes from degradation during DNA replication.

- b) Telomeres promote chromosomal rearrangements that lead to cellular aging.
- c) Shortening of telomeres induces cell cycle arrest and contributes to cellular senescence.**
- d) Telomeres facilitate DNA repair mechanisms that counteract cellular aging.

14. Which of the following accurately describes the mechanism of action of competitive inhibitors in enzyme catalysis?

- a) Competitive inhibitors bind to the active site of the enzyme, preventing substrate binding.**
- b) Competitive inhibitors covalently modify the enzyme, altering its catalytic activity.
- c) Competitive inhibitors bind to allosteric sites, changing the enzyme's conformation.
- d) Competitive inhibitors increase the rate of enzyme-substrate complex formation.

15. Which of the following statements accurately describes the function of reverse transcriptase in retroviral replication?

- a) Reverse transcriptase synthesizes RNA from a DNA template.
- b) Reverse transcriptase synthesizes DNA from an RNA template.**
- c) Reverse transcriptase cleaves viral RNA to produce mature viral proteins.
- d) Reverse transcriptase integrates viral DNA into the host genome.