

CUET PG 2026 Microbiology Question Paper with Solutions(Memory Based)

Time Allowed :1 Hours 30 minutes	Maximum Marks :300	Total Questions :75
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General Instructions

1. The exam lasts 90 minutes (1 hour 30 minutes).
2. There are 75 Multiple Choice Questions (MCQs) to be answered.
3. +4 marks for every correct answer. -1 mark (negative marking) for every incorrect answer. 0 marks for unanswered or un-attempted questions.
4. For any discrepancy in questions, the English version is considered final (except for language-specific papers).
5. Click one of the four options to choose an answer.
6. You must click "Save & Next" to confirm your response. Only saved answers are considered for evaluation.
7. Use "Mark for Review & Next" to flag a question for later. You can unselect or change your answer using the "Clear Response" button.
8. All calculations must be done on the Rough Sheets provided at the centre. These must be returned to the invigilator after the exam.

1. Which scientist is known as the "Father of Microbiology" for first observing "animalcules"?

- (A) Louis Pasteur
- (B) Robert Koch
- (C) Antonie van Leeuwenhoek
- (D) Edward Jenner

Correct Answer: (C) Antonie van Leeuwenhoek

Solution:

Step 1: Understanding the Concept:

The origins of microbiology are tied to the first visual confirmation of microorganisms.

Early observers used simple but powerful magnifying lenses to see life forms invisible to the naked eye.

Step 2: Detailed Explanation:

Antonie van Leeuwenhoek (1632–1723) was a Dutch scientist who designed high-quality single-lens microscopes.

In 1674, while examining samples of pond water and dental scrapings, he observed tiny, moving organisms.

He described these organisms in letters to the Royal Society of London, calling them "animalcules," which literally translates to "little animals."

His observations provided the first evidence of the existence of bacteria and protozoa.

Louis Pasteur and Robert Koch are renowned for the Germ Theory and disease identification, but Leeuwenhoek was the first to see the microbes themselves.

Step 3: Final Answer:

The scientist known as the "Father of Microbiology" for first observing "animalcules" is Antonie van Leeuwenhoek.

💡 Quick Tip

Associate "Animalcules" with Antonie van Leeuwenhoek.

He is the "Father of Microbiology" for discovery, while Pasteur is often called the "Father of Modern Microbiology" for his work on fermentation and vaccines.

2. What is the primary component of the bacterial cell wall that is absent in Archaea?

- (A) Cellulose
- (B) Peptidoglycan
- (C) Chitin
- (D) Glycogen

Correct Answer: (B) Peptidoglycan

Solution:

Step 1: Understanding the Concept:

Bacteria and Archaea are both prokaryotic, but they belong to different domains of life based on significant biochemical differences.

One of the most fundamental differences lies in the chemical composition of their cell walls.

Step 2: Detailed Explanation:

Bacterial cell walls are characterized by the presence of Peptidoglycan (murein).

Peptidoglycan is a polymer consisting of sugars (N-acetylglucosamine and N-acetylmuramic acid) and amino acids.

Archaea do not contain peptidoglycan.

Instead, Archaea may have cell walls composed of pseudopeptidoglycan (pseudomurein), polysaccharides, or proteins (S-layers).

Cellulose is found in plant cell walls, Chitin is found in fungal cell walls, and Glycogen is a storage molecule, not a structural cell wall component.

Step 3: Final Answer:

The primary component found in bacterial cell walls but absent in Archaea is Peptidoglycan.

💡 Quick Tip

Antibiotics like Penicillin target the synthesis of peptidoglycan. Since Archaea lack peptidoglycan, they are naturally resistant to these types of antibiotics.

3. Which staining technique is used specifically to identify *Mycobacterium tuberculosis*?

- (A) Gram Staining
- (B) Acid-fast Staining
- (C) Capsule Staining
- (D) Endospore Staining

Correct Answer: (B) Acid-fast Staining

Solution:**Step 1: Understanding the Concept:**

Certain bacteria have cell walls with high lipid content that makes them resistant to conventional staining methods like Gram staining.

Step 2: Detailed Explanation:

Mycobacterium tuberculosis has a cell wall rich in mycolic acids (waxy long-chain fatty acids). This waxy layer prevents standard aqueous dyes from penetrating the cell wall.

The Acid-fast staining technique (Ziehl-Neelsen or Kinyoun method) uses heat or a high concentration of phenol to drive the primary stain (Carbol Fuchsin) into the cell.

Once stained, these cells resist decolorization by acid-alcohol, which is why they are called "acid-fast."

Non-acid-fast bacteria lose the primary stain and take up the counterstain (Methylene Blue).

Step 3: Final Answer:

The specific staining technique for identifying *Mycobacterium tuberculosis* is Acid-fast Staining.

💡 Quick Tip

If the question mentions "Mycolic acid," "Mycobacterium," or "Leprosy/Tuberculosis," always think of Acid-fast Staining.

4. In the Lac Operon, which molecule acts as an inducer?

- (A) Glucose
- (B) Lactose
- (C) Galactose
- (D) Maltose

Correct Answer: (B) Lactose

Solution:

Step 1: Understanding the Concept:

The Lac Operon is a classic model of gene regulation in bacteria, controlling the metabolism of lactose.

Step 2: Detailed Explanation:

An inducer is a molecule that initiates gene expression by interacting with a repressor protein. In the absence of lactose, the Lac repressor binds to the operator, preventing transcription of the structural genes (*lacZ*, *lacY*, *lacA*).

When lactose enters the cell, it is converted into an isomer called allolactose.

Allolactose (or lactose in broader terms) acts as the inducer by binding to the repressor.

This binding causes the repressor to change shape and release the DNA, allowing RNA polymerase to begin transcription.

While allolactose is the molecular inducer, "Lactose" is typically used as the answer in general microbiology contexts.

Step 3: Final Answer:

In the Lac Operon system, Lactose acts as the inducer molecule.

💡 Quick Tip

The Lac Operon is "Inducible" because the presence of the substrate (Lactose) induces the synthesis of the enzymes needed to digest it.

5. Which type of antibody is the only one capable of crossing the human placenta?

- (A) IgA
- (B) IgM
- (C) IgG
- (D) IgE

Correct Answer: (C) IgG

Solution:

Step 1: Understanding the Concept:

Maternal antibodies are transferred to the fetus to provide passive immunity during the early stages of life.

Step 2: Detailed Explanation:

There are five main classes of immunoglobulins: IgA, IgD, IgE, IgG, and IgM.

IgG is the most abundant antibody in human serum and is the smallest in size (monomer).

It is the only class of immunoglobulin that can cross the placenta from the mother to the fetus.

This transfer is facilitated by specific neonatal Fc receptors (FcRn) on the placenta.

IgM is a large pentamer and cannot cross.

IgA is primarily found in secretions like breast milk (colostrum) and provides immunity after birth.

Step 3: Final Answer:

The antibody capable of crossing the human placenta is IgG.

💡 Quick Tip

Remember: "G" crosses the "G"estation barrier (placenta).

IgG = Gestation/Placenta. IgA = Alimentary/Milk. IgM = Mega/Main (first response).

6. What is the name of the process by which bacteria take up naked DNA from their environment?

- (A) Transduction
- (B) Conjugation
- (C) Transformation
- (D) Translation

Correct Answer: (C) Transformation

Solution:

Step 1: Understanding the Concept:

Bacteria can acquire new genetic information through horizontal gene transfer (HGT), which allows for rapid adaptation and antibiotic resistance.

Step 2: Detailed Explanation:

There are three main mechanisms of horizontal gene transfer:

1. **Transformation:** The process where a competent bacterial cell takes up free, "naked" DNA fragments released by dead or lysed cells in the environment.
2. **Transduction:** DNA transfer mediated by a bacteriophage (virus).
3. **Conjugation:** DNA transfer through direct cell-to-cell contact via a sex pilus (mating).

Translation is the process of making protein from mRNA and is not a gene transfer mechanism.

Step 3: Final Answer:

The process of taking up naked DNA from the environment is called Transformation.

 Quick Tip

Transformation = Free DNA. Transduction = Viral delivery. Conjugation = Bacterial "mating".

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

- (A) DNA polymerase
- (B) RNA polymerase
- (C) Ligase
- (D) Helicase

Correct Answer: (B) RNA polymerase

Solution:

Step 1: Understanding the Concept:

Transcription is the first step of gene expression, where the information in a DNA sequence is copied into a complementary RNA molecule.

Step 2: Detailed Explanation:

RNA polymerase is the enzyme that carries out transcription.

It binds to the DNA at a promoter site, unwinds the double helix, and adds ribonucleotides (A, U, G, C) to form an RNA strand based on the DNA template.

DNA polymerase is used for DNA replication (DNA to DNA).

Helicase unwinds the DNA strands during replication.

Ligase seals nicks in the DNA backbone.

Step 3: Final Answer:

The enzyme responsible for RNA synthesis is RNA polymerase.

 Quick Tip

Always check the product being made. If the product is RNA, the enzyme is RNA polymerase. If the product is DNA, it is DNA polymerase.

8. What is the typical pore size of a membrane filter used to sterilize heat-sensitive liquids?

- (A) 1.0 μm
- (B) 0.45 μm
- (C) 0.22 μm
- (D) 5.0 μm

Correct Answer: (C) 0.22 μm

Solution:

Step 1: Understanding the Concept:

Filtration is a mechanical method to remove microbes from liquids or gases that cannot withstand the high heat of an autoclave (e.g., vaccines, antibiotics).

Step 2: Detailed Explanation:

Microorganisms vary in size, but most common bacteria fall in the range of 0.5 to 2.0 μm in diameter.

To ensure that all vegetative bacterial cells are removed, a membrane filter with a pore size smaller than the smallest bacteria must be used.

The industry standard for bacterial sterilization is a pore size of 0.22 μm .

While 0.45 μm filters are sometimes used for general clarification, they may allow smaller bacteria like *Pseudomonas* or *Mycoplasma* to pass through.

Viruses are much smaller and usually pass through a 0.22 μm filter.

Step 3: Final Answer:

The typical pore size for sterilizing heat-sensitive liquids is 0.22 μm .

💡 Quick Tip

Standard lab filtration rule: 0.22 μm for sterilization; 0.45 μm for clarification.

9. Which microorganism is primarily used in the commercial production of Citric Acid?

- (A) *Saccharomyces cerevisiae*
- (B) *Aspergillus niger*
- (C) *Lactobacillus acidophilus*
- (D) *Penicillium chrysogenum*

Correct Answer: (B) *Aspergillus niger*

Solution:

Step 1: Understanding the Concept:

Industrial microbiology involves the large-scale cultivation of microbes to produce useful products like organic acids, vitamins, and antibiotics.

Step 2: Detailed Explanation:

Aspergillus niger is a filamentous fungus (mold) that is the dominant organism used for industrial citric acid production.

It is highly efficient at converting sugars (like molasses or sucrose) into citric acid through a specialized fermentation process.

Saccharomyces cerevisiae is used for ethanol and CO₂ (bread/beer).

Lactobacillus acidophilus produces lactic acid.

Penicillium chrysogenum is the main source of the antibiotic penicillin.

Step 3: Final Answer:

Aspergillus niger is the primary organism used for Citric Acid production.

💡 Quick Tip

Associate "Black Mold" (*Aspergillus niger*) with Citric Acid. It is one of the most successful industrial fermentations globally.

10. The Baltimore Classification system categorizes viruses based on which characteristic?

- (A) Shape of the virus
- (B) Type of host infected
- (C) Nature of genetic material and replication strategy
- (D) Size of the virus

Correct Answer: (C) Nature of genetic material and replication strategy

Solution:**Step 1: Understanding the Concept:**

Viruses have diverse genomes (DNA or RNA, single or double-stranded). The Baltimore system organizes this diversity into logical groups.

Step 2: Detailed Explanation:

The Baltimore Classification, proposed by David Baltimore, divides viruses into seven groups based on:

1. The type of nucleic acid in their genome (DNA vs RNA).
2. The strandedness of the genome (single-stranded vs double-stranded).
3. The method they use to produce messenger RNA (mRNA) to synthesize viral proteins.

This system is fundamental because all viruses must produce mRNA that can be read by the

host cell's ribosomes.

Step 3: Final Answer:

The Baltimore system categorizes viruses based on the nature of their genetic material and their replication strategy.

💡 Quick Tip

Group I = dsDNA; Group IV = (+)ssRNA; Group VI = Retroviruses. The key is how they make mRNA.

11. Which nitrogen-fixing bacteria forms a symbiotic relationship with the water fern *Azolla*?

- (A) *Rhizobium*
- (B) *Azotobacter*
- (C) *Anabaena*
- (D) *Clostridium*

Correct Answer: (C) *Anabaena*

Solution:

Step 1: Understanding the Concept:

Biological nitrogen fixation involves converting atmospheric N_2 into ammonia. This is often done by bacteria living inside plant tissues.

Step 2: Detailed Explanation:

Azolla is a small, free-floating aquatic fern.

It has a symbiotic relationship with a cyanobacterium (blue-green alga) called *Anabaena azollae*.

The bacteria live in specialized cavities in the fern's leaves, where they fix nitrogen and provide it to the plant.

In exchange, the fern provides carbohydrates and a protected niche for the bacteria.

This association is highly valued in agriculture, especially in rice cultivation, as a natural nitrogen fertilizer.

Rhizobium is symbiotic with legumes (beans/peas).

Step 3: Final Answer:

The nitrogen-fixing bacteria symbiotic with *Azolla* is *Anabaena*.

💡 Quick Tip

Azolla-Anabaena is the classic example of an aquatic symbiotic nitrogen-fixing system.

12. What is the net yield of ATP molecules produced during the glycolysis of one glucose molecule?

- (A) 2 ATP
- (B) 4 ATP
- (C) 6 ATP
- (D) 8 ATP

Correct Answer: (A) 2 ATP

Solution:

Step 1: Understanding the Concept:

Glycolysis is the metabolic pathway that breaks down glucose into pyruvate, releasing energy in the form of ATP.

Step 2: Key Formula or Approach:

Net ATP = (Gross ATP produced) – (ATP consumed during activation).

Step 2: Detailed Explanation:

Glycolysis consists of two main phases:

1. **Energy-Investment Phase:** 2 ATP molecules are consumed to activate glucose (phosphorylate it).
2. **Energy-Payoff Phase:** 4 ATP molecules are produced via substrate-level phosphorylation (2 per three-carbon unit).

Calculation:

$$4 \text{ ATP (produced)} - 2 \text{ ATP (invested)} = 2 \text{ ATP (net)}$$

Although NADH is also produced (which can yield more ATP in the Electron Transport Chain), the "net yield" of glycolysis refers specifically to the direct ATP output.

Step 3: Final Answer:

The net yield of ATP from one molecule of glucose during glycolysis is 2 ATP.

💡 Quick Tip

Be careful with the wording: "Gross yield" is 4 ATP, but "Net yield" is 2 ATP.

13. Which class of MHC molecules is found on the surface of all nucleated cells?

- (A) MHC Class I
- (B) MHC Class II
- (C) MHC Class III
- (D) MHC Class IV

Correct Answer: (A) MHC Class I

Solution:

Step 1: Understanding the Concept:

MHC (Major Histocompatibility Complex) molecules are essential for the immune system to recognize "self" vs "non-self".

Step 2: Detailed Explanation:

MHC Class I: These molecules are expressed on the surface of virtually all nucleated cells in the body. They present internal (endogenous) antigens to $CD8^+$ cytotoxic T-cells. This allows the immune system to monitor if a cell is infected by a virus or has become cancerous.

MHC Class II: These are only found on specialized Antigen-Presenting Cells (APCs) like macrophages, B-cells, and dendritic cells. They present external (exogenous) antigens to $CD4^+$ helper T-cells.

Red blood cells lack a nucleus and therefore do not express MHC Class I.

Step 3: Final Answer:

MHC Class I molecules are found on all nucleated cells.

💡 Quick Tip

Nucleus = MHC I.

Specialized Immune Cell (APC) = MHC II.

14. What is the main structural protein that forms the capsid of a virus?

- (A) Glycoprotein
- (B) Capsomere
- (C) Nucleoprotein
- (D) Lipoprotein

Correct Answer: (B) Capsomere

Solution:

Step 1: Understanding the Concept:

The capsid is the protein shell that surrounds and protects the viral genetic material.

Step 2: Detailed Explanation:

The capsid is not a single giant protein; it is built from many repeating individual protein subunits.

These individual structural subunits are called capsomeres.

Capsomeres self-assemble to form the overall geometric shape of the virus (e.g., icosahedral or helical).

Glycoproteins are usually part of the envelope spikes.

Nucleoproteins are proteins complexed with the viral genome.

Step 3: Final Answer:

The main structural proteins forming the capsid are Capsomeres.

💡 Quick Tip

Capsid = The whole shell.

Capsomere = The individual subunit "bricks".

15. Which method is used to determine the Minimum Inhibitory Concentration (MIC) of an antibiotic?

- (A) Disk diffusion method
- (B) Broth dilution method
- (C) Gram staining
- (D) Streak plate method

Correct Answer: (B) Broth dilution method

Solution:**Step 1: Understanding the Concept:**

MIC is the lowest concentration of an antibiotic that prevents the visible growth of a specific bacteria. It is a critical value for determining the effectiveness of a drug.

Step 2: Detailed Explanation:

The Broth Dilution Method involves adding a standard amount of bacteria to tubes (or wells) containing serial dilutions of the antibiotic.

After incubation, the tubes are checked for turbidity (cloudiness), which indicates growth.

The first tube in the series with no visible growth represents the Minimum Inhibitory Concentration.

The Disk Diffusion (Kirby-Bauer) method is qualitative; it measures the size of a "zone of inhibition" but does not provide a specific MIC value.

Gram staining is for identification, and streak plates are for isolation.

Step 3: Final Answer:

The Broth dilution method is used to determine the MIC.

💡 Quick Tip

MIC = Quantitative (reports a concentration like 2 $\mu\text{g/mL}$).

Disk Diffusion = Qualitative (reports S/I/R: Sensitive, Intermediate, or Resistant).
