

I. (30 points)

1. (a) Please define "biofilm" (3 points). (b) What are benefits of biofilm for microorganisms (4 points)?
2. (a) Please describe the differences between the Gram (-) and Gram (+) bacteria. (4 points)
(b) Why Gram staining can divide bacteria into two groups? (3 points) (c) Please list the full name of two bacteria that belongs to Gram (-) and Gram (+), respectively. (4 points)
3. Please "compare and contrast" the bacteria and fungi. (6 points)
4. Please define the "selective" media and "differential" media. (6 points)

II. (12 points)**Definitions and Explanations of Terms**

1. Quorum sensing (4 points)
2. Virulence factor (2 points)
3. Pathogenicity factor (2 points)
4. MBC and MIC (2 points)
5. Biotype and serotype (2 points)

III. (8 points)

For each of the following antibiotics, briefly describe how the antibiotic kills or inhibits the growth of bacteria.

1. Penicillin (2 points)
2. Kanamycin (2 points)
3. Vancomycin (2 points)
4. Gentamicin (2 points)

IV. (30 points)**Comparison of the following terms**

1. Lysogen and provirus (6 points)
2. F plasmid and Hfr strain (6 points)
3. Polycistronic mRNA and monocistronic mRNA (6 points)
4. Lag phase and exponential phase of *E. coli* (6 points)
5. Prototroph and auxotroph (6 points)

V. (20 points)**Answer the following questions**

1. Define the Lac operon. How is the Lac operon regulated in *E. coli*? (10 points)
2. Describe how conjugation, transformation, and transduction are similar. How are they different? (10 points)