

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Bacteriology

1. Bacterial pathogens utilize a multitude of methods to invade mammalian hosts, damage tissue sites, and thwart the immune system from responding.
 - (a). One essential component of these strategies for many bacterial pathogens is the secretion of proteins across phospholipid membranes. Please describe at least one example of protein secretion system used by any bacterial pathogens? (10%)
 - (b). Many bacterial toxins are proteins, encoded by the bacterial chromosomal genes, plasmids, or phages. Please select **ONE** of the bacteria from *Clostridium difficile*, *Staphylococcus aureus*, and *Bacillus anthracis*, and describe its gram reaction, toxins, and the virulence mechanism by which the toxins cause damage. (10%)
2. In 1890 Robert Koch postulated guidelines to establish a standard for evidence of causation in infectious disease. His postulates became the gold standard to define microbial virulence for over 100 years, despite limitations to their experimental applications for a number of microorganisms. Please describe Koch's postulates and explain the limitations. (10%)
3. Antibiotics are arguably the most successful form of chemotherapy developed in the twentieth century and perhaps over the entire history of medicine. Please group antibiotics by the mechanism of action and give at least one antibiotic for each group. (10%)
4. To image you are the principal investigator at a bacteriology laboratory. Please design serial experiments to identify the virulence genes of a specific bacterium, including the tests or assays *in vitro* and *in vivo*. (10%)

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Virology

1. High levels of cytokine interferon gamma are detected in the sera of dengue virus-infected patients with fatal diseases. Please design experiments to determine the role of interferon gamma in dengue virus infection (15%).
2. Please describe how the following viruses replicate their genomes (20%)
 - (a) the virus, such as herpes simplex virus, with a double-strand DNA genome
 - (b) the virus, such as enterovirus 71, with a single-stranded, positive sense RNA genome
 - (c) the virus, such as rabies virus, with a single-stranded, negative sense RNA genome
 - (d) human immunodeficiency virus (HIV)
3. Zika virus is scary because it has been linked to the birth defect microcephaly (小腦症). Please design experiments to determine whether Zika virus infection can cause microcephaly (15%).