※ 注意：請於試卷內之「非選擇題作答區」依序作答，並應註明作答之大題及小題題號

合訂本6本

Part A (50 points)

I. **(2 points)** Which types of microorganisms are acellular?

(A) Viruses (B) Archaea (C) Protists (D) Fungi (E) Satellites (F) Prions

II. **(5 points)**

(1) What are the differences between "passive diffusion" and "active transport"?

(2) Please explain “primary active transport” and “secondary active transport”.

III. **(3 points)** Explain why bacterial endospores are of particular concern to the food industry.

IV. **(3 points)** Please explain the differences between “aerobic mitochondrion” and “anaerobic mitochondrion”.

V. **(6 points)** Please list **three** potential ways oncoviruses can cause cancer.

VI. **(5 points)** Viroids are infectious agents that consist only of RNA.

(1) How do viroids stabilize RNA?

(2) Please explain how viroids replicate within host cells.

VII. **(6 points)** Describe **three** potential adaptions that allow halophilic bacterial to survive in environments with high salt concentrations.

VIII. **(6 points)** Please explain why biofilms are more resistant to antibiotics. (List at least **3** reasons)

IX. **(8 points)** Antibiotics could inhibit cell growth by blocking protein synthesis.

(1) Name two antibiotics that belong to this category.

(2) Please describe the potential mechanisms by which these antibiotics block protein synthesis.

X. **(6 points)** There are six different CO_2-fixation pathways have been identified in microorganisms. Please list two and explain them.

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Part B (50 points)

I. (10 points) Some bacteria have evolved unbelievable powers that allow them to survive in any possible environment. Please write down the unique environment in which you can find each bacteria below and describe the extraordinary superpower they possess to live in those environments. (1) *Thermus aquaticus* (2) *Deinococcus radiodurans* (3) *Ideonella sakaiensis* (4) *Akkermansia mucinophila* (5) *Leptothrix* spp.

II. (12 points) What's the difference between each pair of terms?

(1) virulent phage and temperate phage (2) coenocytic hypha and septate hypha (3) antigen and hapten (4) precipitation and agglutination in immune complex formation (5) frank and opportunistic pathogens (6) Exotoxin and endotoxin

III. (6 points) Please assign one of the following characteristics (A)~(I) to each category of protists below.

(A) demonstrate unusual motility termed "jump-drag-skedaddle" (B) form pseudoplasmodium (C) form plasmodium (D) can precipitate $CaCO_3$ and influence Earth's carbon budget (E) produce about 50 % of the organic carbon in the ocean (F) contains tubular cristae in their mitochondria and possession of heterokont flagella (G) possesses hydrogenosome for ATP synthesis (H) uses chlorophyll a and b for photosynthesis (I) causes Chagas disease

(1) *Stramenopila* (2) *Euglena* (3) Coccolithales (4) Picozoa (5) *Dictyostelia* (6) *Giardia*

IV. (8 points) Mammalian hosts and their normal microbiota can produce chemical mediators to protect themselves against microbial invasion. What is the major mechanism used by the following chemicals to kill or inhibit microorganisms?

(1) lysozyme (2) lactoferrin (3) lactoperoxidase (4) bacteriocin

V. (6 points) (1) Recently, the measles outbreak brought our attention to this negative-strand RNA virus. According to the Baltimore system, what is the primary difference in the replication mechanisms between positive and negative-strand RNA viruses? (2 points) (2) According to the Baltimore system, human immunodeficiency virus (HIV) and Hepatitis B virus are classified in Groups VI and VII, respectively. What are the similarities and differences between these two viruses? (4 points)

VI. (4 points) Diseases caused by pathogens can be transmitted via different routes. Please give one example (pathogen or disease) for each of the following routes.

(1) water-borne (2) vector-borne (3) food-borne (4) zoonotic disease

VII. (4 points) Please explain why humans, animals and plants are "holobionts"? If we want to study "holobionts," do you think what the key technology that we should use is?

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