注意：考試開始鈴響前，不得翻閱試題，
並不得書寫、畫記、作答。

國立清華大學 112 學年度碩士班考試入學試題

系所班組別：生命科學暨醫學院
甲組(生物與醫學科學組)

科目代碼：0403

考試科目：微生物學

—作答注意事項—

1. 請核對答案卷（卡）上之准考證號、科目名稱是否正確。
2. 考試開始後，請於作答前先翻閱整份試題，是否有污損或試題印刷不清，得舉手請監試人員處理，但不得要求解釋題意。
3. 考生限在答案卷上標記「▛ 由此開始作答」區內作答，且不可書寫姓名、准考證號或與作答無關之其他文字或符號。
4. 答案卷用盡不得要求加頁。
5. 答案卷可用任何書寫工具作答，惟為方便閱卷辨識，請儘量使用藍色或黑色書寫；答案卡限用 2B 鉛筆畫記；如畫記不清（含未依範例畫記）致光學閱讀機無法辨識答案者，其後果一律由考生自行負責。
6. 其他應考規則、違規處理及扣分方式，請自行詳閱准考證明上「**國立清華大學試場規則及違規處理辦法**」，無法因本試題封面作答注意事項中未列明而稱未知悉。

國立清華大學 112 學年度碩士班考試入學試題

系所班組別：生命科學暨醫學院甲組、丁組

考試科目（代碼）：微生物學(0403、0703)

I. Single choice 單選題 (2 points/each, total 48 points)

1. Please choose one microbe that can commonly cause food-borne diseases.
   A. Cryptococcus neoformans
   B. Bordetella pertussis
   C. *Clostridium botulinum*
   D. Candida albicans
   E. Schizosaccharomyces pombe

2. Choose a wrong statement related the fungi and protists.
   A. Important zygomycota include *Saccharomyces cerevisiae* and *Aspergillus fumigatus*.
   B. Fungi are major decomposers of nature and can break down organic matters.
   C. Histoplasmosis is a fungal lung infection, commonly caused by *Histoplasma capsulatum*.
   D. Malaria is a life-threatening disease caused by *Plasmodium parasites*.
   E. *Trichomoniasis* is a common sexually transmitted infection caused by a parasite.

3. Which of the following is true related to bacteria.
   A. Mycoplasmas are stained as Gram-positive due to their thick waxy cell envelope.
   B. *Deinococcus radiodurans* facilitates oxygenic photosynthesis using phycobilisomes that contain light-harvesting pigments.
   C. Alpha-proteobacteria are the largest subgroup of proteobacteria, including the pseudomonads.
   D. *Acinetobacteria baumannii* is one of the most common causing agents for hospital-acquired infectious diseases such as pneumonia.
   E. Hemolysis is an important property to identify the genus *Streptococcus*, in which alpha-hemolysis is characterized by a clear zone of complete lysis in blood agar plates.

4. Which is true regarding bacterial endotoxins?
   A. Produced only by Gram-positive bacteria.
   B. Bacterial endotoxins are heat stable and weakly immunogenic.
   C. Bacterial endotoxins cannot cause fever.
   D. Bacterial endotoxins are neurotoxins that can target nerve tissue.
   E. The A subunit of an endotoxin is responsible for toxic effect.

5. Choose a correct statement from a comparison of *Bacteria*, *Archaea* and *Eukarya*.
   A. Membrane-enclosed nucleus with nucleolus are present in both *Archaea* and *Eukarya*.
   B. The mRNA introns are present in both *Archaea* and *Eukarya*.
   C. Methanogenesis is present in both *Bacteria* and *Archaea*.
   D. Nitrogen fixation is present only in *Bacteria*.
   E. Both *Archaea* and *Eukarya* are not sensitive to chloramphenicol.

6. For a light microscope, a 60× objective and a 10× ocular produce a total magnification of
   A. 900×
   B. 750×
   C. 600×
   D. 70×
   E. 50×

7. Which of the following is true about the uptake of nutrients in microbes?
   A. Group translocation is found in *Eukarya*.
   B. Endocytosis is found in *Bacteria*.
   C. Facilitated diffusion needs ATP hydrolysis to provide energy.
   D. ATP-binding cassette transporters are primary active transporters which use energy from proton motive force to drive transport.
   E. Secondary active transporters are cotransporters which use ion gradients to cotransport substances.

8. Which of the following is not correct about bacteria?
   A. Mycoplasmas lack a cell wall.
   B. The nucleoid in bacteria contains chromosome and histones.
   C. Most of the membranes in bacteria lack cholesterol.
   D. The size of a bacterial ribosome is 70S.
   E. Some bacteria contain intracytoplasmic membranes to provide a larger membrane surface for greater metabolic activity.

9. Which of the following is true of the bacterial lipopolysaccharide (LPS)?
   A. The core polysaccharide part of LPS contributes to negative charge on cell surface.
   B. The O antigen is the most conserved (constant) part of LPS.
   C. It is found in the plasma membrane of gram-negative bacteria.
   D. It is found in the outer membrane of gram-positive bacteria.
   E. The lipid A part of LPS can act as an exotoxin.

10. Moist heat sterilization at 100°C kills all of the following EXCEPT _____.
   A. bacterial endospores
   B. fungal spores
   C. viruses
   D. protozoa
   E. slime molds

11. Development of drug resistance is encouraged by _____.
   A. use of a high enough concentration of the drug to destroy any spontaneous resistant mutants that might arise
   B. use of two drugs simultaneously with the hope that each will prevent the emergence of resistance to the other
   C. avoidance of indiscriminate (不加區別的) use of drugs
   D. widespread use of broad-spectrum drugs
   E. using drugs appropriate for the infectious agent being treated

12. All of the following statements are true except:
    A. Col plasmids encode colicin which kills strains of *E. coli*.
    B. Plasmids which carry genes encoding degradative enzymes for pesticides are called metabolic plasmids.
    C. All bacteriocin genes are on plasmids.
    D. R factors have genes for resistance to antibiotics and these resistance genes are often within transposons.
    E. F factor of *E. coli* is both a conjugative plasmid and an episome.

13. If you forgot to heat fix a smear before doing a Gram stain, which of the following might occur?
    A. The stains would not adhere to the bacteria.
    B. The smear may not adhere to the slide.
    C. The decolorization step of the Gram stain would not work properly.
    D. Gram-positive and Gram-negative bacteria would both stain purple.
    E. Gram-positive and Gram-negative bacteria would both stain red.

14. SARS-CoV-2 causes by
    A. Herpesvirus
    B. Adenovirus
    C. Coronavirus
    D. Rotavirus
    E. Retrovirus

15. Angiotensin-converting enzyme 2 is not a
    A. membrane protein
    B. SARS-CoV-2 receptor
    C. vasodilator
    D. Virus
    E. target for the development of anti-SARS-CoV-2 drug

16. RNA-dependent RNA polymerase of SARS-CoV-2 is not a
    A. non-structural protein
    B. structural protein
    C. enzyme
    D. viral protein
    E. target for the development of anti-SARS-CoV-2 drug

17. The spike protein of SARS-CoV-2 is not a
    A. structural protein
    B. polymerase
    C. enveloped protein
    D. target for the development of anti-SARS-CoV-2 drug
    E. receptor binding protein

18. Which of the following is not an Omicron subvariant of SARS-CoV-2
    A. BA.4
    B. BA.5
    C. BBQ
    D. BQ.1.1
    E. BQ.1

19. Which of the following is incorrect regarding the SARS-CoV-2 vaccines?
    A. Moderna vaccines are mRNA vaccines
    B. Pfizer-BioNTech vaccines are mRNA vaccines
    C. AstraZeneca vaccines are virus vector vaccines
    D. Novavax COVID-19 vaccines are mRNA vaccines
    E. Medigen COVID-19 vaccines are protein subunit vaccines.

20. Which is not true of viruses?
    A. Animal and plant cells are the only cells infected by these viruses.
    B. It is possible for them to exist intracellularly or extracellularly.
    C. Replication occurs only within host cells.
    D. They are acellular.
    E. Electron microscopes can be used to observe them.

21. A complete virus particle is referred to as a
    A. matrix.
    B. envelope.
    C. capsid.
    D. cell.
    E. virion.

22. Viral capsid protein subunits are called
    A. viromers.
    B. protomers.
    C. auxomers.
    D. primers.
    E. monomers.

23. The part of an enveloped virus that consists of the nucleic acid and genome and the surrounding protein coat, but not the envelope, is referred to as the
    A. endosome.
    B. ribosome.
    C. matrix.
    D. nucleocapsid.
    E. spike.

24. An outer surface of viral envelopes is covered with glycoprotein spikes that function as
    A. binding to host cell.
    B. cell lysis.
    C. toxin.
    D. polymerase.
    E. primers.

II. Term description 解釋名詞 (35 points)

1. Opportunistic pathogens (3 points)
2. Colony forming units (CFU) (3 points)
3. Transcriptome (3 points)
4. Osmophiles (3 points)
5. Bioremediation (3 points)
6. Spheroplast (3 points)
7. Universal phylogenetic tree (3 points)
8. Facultative anaerobe (2 points)
9. SARS-CoV-2 Immune escape (3 points)
10. Long COVID (3 points)
11. antibody dependent enhancement (3 points)
12. SARS-CoV-2 pseudovirus (3 points)

III. Short answers 簡答題 (8 points)

1. Why is the 16S rDNA sequences commonly used for bacterial identification and phylogenetic reconstruction? (4 points)
2. Please explain why *Agrobacterium tumefaciens* is important? (2 points)
3. What does "auxotrophic bacteria" mean? (2 points)

IV. Long answer 問答題 (9 points)

1. Briefly describe three techniques by which microbial population numbers may be determined and give their advantages and disadvantages. (9 points)