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 108 學年度碩士班考試入學試題

系所班組別：**生命科學院 丁組**

考試科目(代碼)：**微生物學**(0703)

－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. 作答中如有發現試題印刷不清，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 108 學年度碩士班考試入學試題

系所班組別：生命科學院甲組、丁組

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I. Single choice (每題 2 分，共 54 分)

1. For a light microscope, a 30× objective and a 10× ocular produce a total magnification of
   A. 40×
   B. 300×
   C. 3×
   D. 600×
   E. 20×

2. Which of the following statements is not correct about bacterial cytoskeleton?
   A. CreS is a homologue of lamin and keratin, and can help bacteria to maintain a curved shape.
   B. Cytoskeletal protein MamK can help the formation of magnetosome chains.
   C. MreB is a homologue of actin and many rod-shaped bacteria and archaea have it.
   D. ParA is a cytoskeletal protein which can help to ensure segregation of carboxysomes.
   E. FtsZ is a homologue of intermediate filament and can form a ring during septum formation in cell division.

3. 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.

4. The minimal lethal concentration (MLC) is the
   A. lowest concentration of a drug that prevents growth of a particular pathogen.
   B. highest concentration of a drug that prevents growth of a particular pathogen.
   C. lowest concentration of a drug that kills a particular pathogen.
   D. highest concentration of a drug that kills a particular pathogen.
   E. lowest concentration of a drug that promotes growth of a particular pathogen.

5. The disinfectant action of phenol and phenolic derivatives mainly is due to
   A. its inherent detergent action.
   B. oxidation of disulfide bonds in proteins.
   C. extraction of lipids from membranes.
   D. membrane damage and protein denaturation.
   E. damage to nucleic acids and proteins caused by free radicals.

6. You are studying a newly discovered prokaryotic microorganism and are attempting to determine whether it will be classified in the domain Bacteria or in the domain Archaea. All of the following would be helpful in making that distinction except
   A. Type of membrane lipids
   B. Presence or absence of peptidoglycan in cell walls
   C. The protein composition of ribosomes
   D. Sequence of small subunit ribosomal RNA
   E. Presence or absence of double-stranded circular DNA genome

7. A growth medium that distinguishes among different groups of bacteria on the basis of their biological characteristics is called a _____ medium.
   A. selective
   B. differential
   C. enrichment
   D. transport
   E. defined

8. Protists contain all of the following forms of life except:
   A. protozoa.
   B. algae.
   C. fungi.
   D. slime molds.
   E. water molds.
9. The nucleic acids carried by viruses usually consist of
   A. DNA
   B. RNA
   C. either DNA or RNA
   D. both DNA and RNA
   E. Nether DNA nor RNA
10. A complete virus particle is called a
   A. capsid
   B. nucleocapsid
   C. virion
   D. cell
   E. bacterium
11. A _____ genome exists as several separate, nonidentical molecules that may be packaged together or separately.
   A. diploid
   B. segmented
   C. polyploid
   D. fractionated
   E. linear
12. The protein coat surrounding the viral genome is called the
   A. capsule.
   B. capsid.
   C. matrix.
   D. envelope.
   E. nucleic acids.

13. Which of the following has been associated with a form of liver cancer?
    A. Human papilloma virus.
    B. Hepatitis B virus.
    C. Human T-cell lymphotropic virus.
    D. Hepatitis A virus.
    E. Hepatitis F virus.
14. Hemagglutination is
    A. the clumping together of red blood cells in the presence of a viral suspension.
    B. the binding of iron in the process of a viral suspension.
    C. the clumping together of infected cells in the presence of a viral suspension.
    D. None of the choices are correct.
    E. All of the choices are correct.
15. Viroids are of economic significance because they cause disease in
    A. plants.
    B. animals.
    C. humans.
    D. None of the choices are correct.
    E. All of the choices are correct.
16. Prions are of significance because they cause infections of
    A. domestic animals and humans.
    B. plants.
    C. fungi.
    D. prokaryotes.
    E. All of the choices are correct.
17. Which of the following types of leukocytes is typically elevated in cases of bacterial, rather than viral or helminthic, infection?
    A. Neutrophils.
    B. Basophils.
    C. Monocytes.
    D. Eosinophils.
    E. Platelets.

18. Macrophages are derived from _____.
    A. granulocytes.
    B. basophils.
    C. neutrophils.
    D. monocytes.
    E. Platelets.
19. A mature, activated B cell is called a
    A. plasma cell.
    B. dendritic cell.
    C. natural killer cell.
    D. spleen cell.
    E. All of the choices are correct.
20. Which of the statement is not true for protists?
    A. Protists' energy metabolism occurs within chloroplasts, mitochondria or hydrogenosomes.
    B. Atestate are amoebae that bear external plates, while naked amoebae have no plates.
    C. Many protists are parasitic in humans and animals.
    D. Protists can exist in terrestrial, aquatic and marine environments, and contribute to nutrient cycling.
    E. The cytoplasm of protists can be divided into the endoplasm and ectoplasm.
21. Which statement of antibiotics is correct?
    A. Tetracycline antibiotics can combine with the 5S ribosomal subunit and inhibit bacterial protein synthesis.
    B. Penicillins are antibiotics that can inhibit bacterial DNA replication.
    C. Quinolones inhibit bacterial topoisomerases DNA.
    D. Chloramphenicol binds to 50S ribosomal subunit to inhibit bacterial protein synthesis.
    E. Vancomycin is an inhibitor of bacterial cell wall peptidoglycan synthesis.

22. Which of the following statement is not true for microbial infection and pathogenicity.
    A. The prodromal stage of infectious disease is the time between pathogen entry and development of signs and symptoms.
    B. Neisseria meningitides produces capsule to prevent the host immune cells from effectively capturing.
    C. Droplet nuclei containing pathogen are small particles about 1 to 4 micro-meter diameter and are able to be transmitted over 1 meter distance.
    D. Pathogenicity islands typically associate with tRNA genes in bacterial genome and have different G + C contents from bacterial genome.
    E. In vector-borne transmission, harborage transmission means that pathogen does not undergo changes within its vector.
23. Which of the following statement is wrong for the anammox reaction in bacteria?
    A. In the anammox reaction, ammonium ion acts as the electron donor.
    B. The anammox reaction is a localized anaerobic ammonia oxidation reaction.
    C. Ammonium combines with hydrazine to form hydroxylamine in a reaction catalyzing by nitrite reductase.
    D. Bacteria in the phylum Planctomycetes can perform the anammox reaction and may contribute 70% of nitrogen cycle in oceans.
    E. Hydrazine can be oxidized to form one N2 and four protons and the electrons are passed to nitrite.
24. Please choose one wrong statement for Archaea.
    A. For glucose catabolism, Archaea uses modified versions of the Embden-Meyerhof and Entner-Doudoroff pathways.
    B. Mesophilic archaea contain thaumarchaeol that is an archaeal-specific lipid.
    C. Methanogenic archaea are strict anaerobes and obtain energy through the biosynthesis of methane.
    D. Extreme halophilic archaea are aerobic chemoorganotrophs.
    E. Acetate is incorporated by the glycolysis in the CO2 assimilation process of autotrophic archaea.

25. Microbial toxins promote infection by damaging host tissues and disabling the host immune system. Please choose a wrong statement related to microbial toxins.
    A. Exotoxins are heat-labile proteins that can be inactivated at 60 to 80℃.
    B. Aflatoxins are toxins produced by fungi and exposure to aflatoxins can cause chronic and acute liver diseases and liver cancer.
    C. Endotoxins are the component in the membrane of Gram positive bacteria.
    D. The B portion of the AB toxin can enter the host cell and has enzyme activity to cause toxicity.
    E. Lipid A is toxic component of lipopolysaccharide and can cause systemic effects such as fever, shock, blood coagulation and intestinal hemorrhage.
26. Which of the followings is true for proteobacteria?
    A. Nitrifying bacteria are aerobes that can oxidize ammonia to nitrate or nitrate to nitrite.
    B. The purple nonsulfur bacteria can grow aerobically as chemoorganoheterotrophs and anaerobically as photoorganoheterotrophs.
    C. Bacteria of the genus Pseudomonas are Gram-positive, anaerobic rods.
    D. Purple sulfur bacteria are anaerobes that are usually photolithoautotrophs.
    E. E. coli performs a mixed acid fermentation that requires pyruvate formate-lyase and formate dehydrogenase.
27. Choose a wrong statement for Mollicutes and nonproteobacterial Gram-negative bacteria.
    A. Green sulfur bacteria use hydrogen sulfide, element sulfur and hydrogen as their electron sources.
    B. The bacteriochlorophyll pigments of purple and green bacteria allow them to live in deeper, anoxic aquatic locations.
    C. Some bacteria of the phylum Bacteroidetes are important rumen and intestinal symbionts.
    D. Cyanobacteria contain only chlorophyll a and photosystems I, and therefore perform anoxygenic photosynthesis.
    E. Mycoplasmas are Gram negative because they lack cell walls and many of them require sterols for growth.

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II. Term description (共 33 分)

1. Spheroplast (3 分)
2. Acid-fast staining (3 分)
3. Colony forming units (CFU) (3 分)
4. Toll-like receptors(3 分)
5. Innate immunity (3 分)
6. Superantigens (3 分)
7. Class switching (3 分)
8. lethal dose 50 (3 分)
9. denitrification (3 分)
10. bioremediation (3 分)
11. mutualism (3 分)

III. Short answer (5 分)

1. Please explain the difference between antibiotics that are bacteriostatic and bacteriocidal.

IV. Long answers (8 分)

1. Compare and contrast the cell walls of Gram-positive bacteria and Gram-negative bacteria in details. (8 分)