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並不得書寫、畫記、作答。


國立清華大學 111 學年度碩士班考試入學試題

系所班組別：生命科學院
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。

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系所班組別：生命科學院甲組、丁組

考試科目（代碼）：微生物學(0403、0703)

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*請在【答案卷】作答

I. Single choice 單選題 (2 points/each, total 38 points)

1. Which statement is wrong for fungi and fungal diseases?
 - A. Ascomycota includes molds and yeasts.
 - B. *Aspergillus* species can cause aspergillosis and their main portal of entry to the host is the gastrointestinal tract.
 - C. *Candida albicans* is a member of the human normal microbiota, but can cause different diseases in immunocompromised individuals.
 - D. Basidiomycota includes many common mushrooms.
 - E. Zygomycetes are commonly used in pharmaceutical and food manufacturing.
2. Choose the wrong one from the following statements about bacteria.
 - A. In alpha-hemolysis, a green zone (incomplete hemolysis) was observed around a bacterial colony on blood agar.
 - B. Purple sulfur bacteria oxidize hydrogen sulfide to sulfur and are usually photolithoautotrophs.
 - C. Methylobacteria are proteobacteria that use one-carbon compounds as carbon and energy sources.
 - D. Nitrifying bacteria can oxidize either ammonium to nitrite or nitrate.
 - E. Members of the *Staphylococcus* genus are Gram-negative aerobic bacteria.
3. Please choose the correct statement from comparison among *Bacteria*, *Archaea* and *Eukarya*.
 - A. Both *Archaea* and *Eukarya* contain membrane-enclosed nucleus with nucleolus.
 - B. Gas vesicles are present in *Eukarya*, but not in *Bacteria* and *Archaea*.
 - C. Chemolithotrophy is only present in *Bacteria*, but is absent in *Archaea* and *Eukarya*.
 - D. *Bacteria* are sensitive to rifampicin, but *Archaea* are insensitive to rifampicin.
 - E. The cell wall of *Bacteria* and *Archaea* contain muramic acid, which is absent in *Eukarya* cell wall.

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4. Which is correct regarding bacterial infections and diseases?
 - A. *Yersinia pestis* is a Gram-positive bacterium to cause plague.
 - B. Toxoid is used to describe the condition caused by bacterial toxins in the blood of the host.
 - C. Legionnaires' disease is caused by bacteria transmitted by arthropods.
 - D. Enterotoxigenic *E. coli* (ETEC) can penetrate and multiply within the intestinal epithelial cells to cause diarrhea.
 - E. Botulism is caused by ingesting the botulinum AB neurotoxin, not bacterial cells.
5. Choose a correct statement related to antimicrobial chemotherapy.
 - A. Fluoroquinolones block bacterial DNA replication, by inhibiting DNA gyrase and topoisomerase II.
 - B. Tetracyclines are antibacterial drugs that can inhibit the synthesis of peptidoglycans, the important component of bacterial cell wall.
 - C. Penicillins are bactericidal by inhibiting bacterial cell membrane synthesis.
 - D. Cephalosporins are a class of beta-lactam antibiotics and can disrupt bacterial protein synthesis.
 - E. The Bradford assay is commonly used to measure antimicrobial activity of an antibacterial drug.
6. What is the most convincing reason why "protists" are not considered to be a taxonomic group?
 - A. They are not cellular life forms.
 - B. They are too small to be included among the eukaryotes.
 - C. The group includes both prokaryotic and eukaryotic cell types.
 - D. The organisms often included in this group are very diverse and don't form a cohesive taxon.
 - E. They are present in diverse environments.

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*請在【答案卷】作答

7. You discover a new microbe while working on a biological project. The microbe is taken to a lab that specializes in placing organisms in their correct phylogenetic niche. In order to determine its evolutionary relatedness to other microbes, the lab carries out _____.
- A. Small subunit rRNA (SSU rRNA) analysis
 - B. microscopic analysis
 - C. biochemical tests
 - D. DNA fingerprinting
 - E. mass spectrometry analysis
8. Small internal cell structures are best visualized with a _____.
- A. light microscope
 - B. dark-field microscope
 - C. transmission electron microscope
 - D. scanning electron microscope
 - E. fluorescence microscope
9. Which of the following protects bacteria from lysis in dilute solutions and helps to determine their cellular morphology or shape?
- A. Plasma membrane
 - B. Peptidoglycan
 - C. Capsule
 - D. Gas vacuoles
 - E. Flagella
10. Motile bacteria have been placed in an environment with a gradient of a chemical attractant. Which of the following behaviors would you predict?
- A. The bacteria will randomly switch back and forth between runs and tumbles.
 - B. The bacteria will only exhibit runs away from the chemical.
 - C. The bacteria will reduce tumbling frequency.
 - D. The bacteria will reduce run duration in the direction of the chemical.
 - E. The bacteria will both reduce tumbling frequency and increase run duration in the direction of the chemical.

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*請在【答案卷】作答

11. 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. sequence of small subunit ribosomal RNA
 - B. type of membrane lipids
 - C. presence or absence of peptidoglycan in cell walls
 - D. presence or absence of double-stranded circular DNA genome
 - E. the assembly of flagella
12. At 4:00 p.m. a closed flask of sterile broth is inoculated with 10,000 cells. The lag phase lasts 1 hour. At 9:00 p.m. the log phase culture has a population of approximately 41 million cells. The mean generation time is calculated as _____.
- A. 10 minutes
 - B. 20 minutes
 - C. 30 minutes
 - D. 40 minutes
 - E. 60 minutes
13. A microbiologist is trying to isolate a pathogen expected to be present in very small numbers from a stool specimen in which there are abundant normal microbiota. Which strategy would most likely accomplish this purpose?
- A. Culture on enriched media
 - B. Culture on differential media
 - C. Culture in an anaerobe jar
 - D. Culture on selective agar followed by enrichment culture
 - E. Enrichment culture followed by culture on selective agar
14. Which of the following does not inhibit protein synthesis?
- A. Tetracycline
 - B. Streptomycin
 - C. Penicillin
 - D. Erythromycin
 - E. Chloramphenicol

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15. Which of the following is not true of coronaviruses?
 - A. Coronaviruses contain envelope
 - B. Coronaviruses are negative-sense single-stranded RNA viruses.
 - C. Coronaviruses infect humans
 - D. Coronaviruses infect mammals
 - E. Coronaviruses infect avian species
16. Which of the following is not true of coronavirus disease 2019 (COVID-19)?
 - A. COVID-19 is not pandemic disease
 - B. COVID-19 entry into human cells is mediated by a cell surface receptor angiotensin-converting enzyme
 - C. Patients infected with COVID-19 may cause cytokine storm in patients
 - D. COVID-19 may block interferon-stimulated genes expression
 - E. All of the choices are correct
17. Which is not true of coronavirus disease (COVID-19)?
 - A. COVID-19 is an infectious disease caused by the SARS-CoV-2 virus
 - B. Older people and those with underlying medical conditions like cardiovascular disease or diabetes are more likely to develop serious illness
 - C. Older people and those with underlying medical conditions like chronic respiratory disease or cancer are more likely to develop serious illness
 - D. Get vaccinated when it's your turn and follow local guidance
 - E. All of the choices are correct
18. Which of the following is not true?
 - A. Viral envelopes are composed of lipids
 - B. Viral envelopes are composed of proteins
 - C. Viral envelopes are composed of carbohydrates
 - D. Viral envelopes are composed of nucleic acids
 - E. All of the choices are correct
19. The protein coat that encases viral genetic material is known as a
 - A. matrix
 - B. capsid
 - C. glycoprotein
 - D. lipid
 - E. All of the choices are correct

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II. Term description 解釋名詞 (3 points/each, total 45 points)

1. Antitoxin
2. Infection dose 50
3. Secondary metabolites
4. Psychrophile
5. Mycology
6. Siderophore
7. Decimal reduction time (D value)
8. Gram stain
9. Viral neutralization
10. Artificially acquired immunity
11. Antigenic determinant sites
12. Chronic infection
13. Viroid
14. SARS-COV-2 variants
15. Viral RNA-dependent RNA polymerase

III. Short answers 簡答題 (11 points)

1. Please explain what are autotrophic bacteria, auxotrophic bacteria and chemolithotrophic bacteria. (6 points)
2. Why mycobacteria are acid-fast? (2 points)
3. Why the COVID-19 vaccine booster dose is important? (3 points)

IV. Long answer 問答題 (6 points)

1. Draw a diagram for the assembly of a flagellum in a typical Gram-negative bacterium and describe the mechanism of flagellar rotation and movement. (6 points)