國　立　清　華　大　學　命　題　紙

96 學年度 生命科學院、生命科學院醫學生物科技學程 系（所） 甲 組碩士班入學考試

科目 微生物學 科目代碼 0203、0503 共 7 頁第 1 頁 *請在【答案卷卡】內作答

Single choice (單選題): please choose one of the best answers for each question
(1 point for each; total 30 points)

1. Which of the following is not a human pathogen?
   A. *Neisseria meningitidis*
   B. *Agarobacterium tumefaciens*
   C. *Candida albicans*
   D. *Clostridium perfringens*

2. Which cell is not phagocytic?
   A. Macrophage
   B. Neutrophil
   C. Basophil
   D. Dendritic cell

3. Which description is true for Methanogenic *Archaea*:
   A. Obligate anaerobes that produce methane
   B. Obligate anaerobes that consume methane
   C. Obligate aerobes that produce methane
   D. Obligate aerobes that consume methane

4. Which is true for enzyme induction?
   A. ONPG is a analog of lactose, with a blue color
   B. ONPG can serve as the substrate for the induction of amylase synthesis
   C. As an inducer, ONPG can be hydrolyzed to galactose and a colorless nitrophenolate ion
   D. In the *E. coli* lactose operon, *LacY* gene encodes for galactoside permease

5. Which mode of action is true for tetracycline?
   A. Tetracycline inhibits cell wall synthesis of bacteria
   B. Tetracycline prevents transcription of the *N*-acetylmuramic acids and results in a weakened peptidoglycan structure of bacteria
   C. Tetracycline has an affinity for bacterial ribosomes and can interfere with aminoacyl-tRNA binding
   D. Tetracycline can block RNA synthesis by binding to and inhibiting the DNA-dependent RNA polymerase

6. Which is true for Cryptococcosis?
   A. Cryptotcoccosis id caused by a pathogenic bacteria, *Cryptococcus neoformans*
   B. Aged, dried dog body fluids are an apparent source of infection
   C. Once the nervous system is involved, cryptococcal meningitis usually results
   D. Treatment of cryptococcosis included ampicillin and tetracyclines

7. Malaria is an important human disease. Which is not true for this disease?
   A. The parasite *Plasmodium* is the causative agent of malaria
   B. The parasite first enters the bloodstream through the bite of an infected female *Anopheles* mosquito
   C. The sporozoites are injected into human with saliva of mosquito and penetrate kidney cell of humans
   D. Diagnosis of malaria is made by demonstrating the presence of parasite within Wright- or Giemsa-stained erythrocytes

8. Staphylococci are among the most important human pathogens. Which is true for Staphylococcal diseases?
   A. Acid-fast stains are of important in making a diagnosis of these diseases
   B. Toxic shock syndrome is a staphylococcal disease with potentially serious consequences
   C. Tetanus is caused by *Staphylococcus aureus*
   D. *Staphylococcus aureus* can produce large amounts of alginate polymers, which are important for causing cystic fibrosis

9. Biochemical characteristics are important for bacterial identification in the clinical microbiology laboratory. Which is not true for the following biochemical test?
   A. Catalase test is used to detect the ability of bacteria to convert hydrogen peroxide to water and O_2
   B. Catalase test is used to differentiate *Streptococcus* (catalase-positive) and *Staphylococcus* (catalase-negative)
   C. Coagulase test is to detect the ability of bacteria to cause plasma to clot
   D. Coagulase test is important to differentiate *Staphylococcus aureus* (coagulase-positive) and *S. epidermidis* (coagulase-negative)

10. Which of the following animal viruses belong to RNA viruses?
   A. Adenoviruses
   B. Polyomaviruses
   C. Coronaviruses
   D. Papillomaviruses

11. For DNA viruses, transcription usually uses host RNA polymerase except for:
    A. Parvociruses
    B. Papovaviruses
    C. Herpesviruses
    D. Poxviruses

12. Retroviruses have a (+)ssRNA as their genome. To complete an infection, they need first make a _____ molecule, which they will use to direct the synthesis of mRNA.
    A. dsRNA
    B. dsDNA
    C. DNA:RNA hybrid
    D. (-)ssRNA

13. In microbial genomic research, the term "contig" refers to:
    A. Chromosomal genes that are contiguous
    B. Chrosomal transcription units that are adjacent
    C. Overlapping nucleotide sequences that are adjacent in the genome
    D. Large DNA fragments produced by restriction endonuclease cleavage

14. Whish of the following molecules are broad spectrum antimicrobial peptides released from neutrophiles?
    A. Adhesins
    B. Defensins
    C. Integrins
    D. Selectins

15. An infection known as blood poisoning is called:
    A. Septicemia
    B. Systemic
    C. Toxemia
    D. Phytogenic

16. If the decolorizer is left on too long in the Gram-staining procedure, gram-positive organisms will be stained _____ and gram-negative organisms will be stained _____.
    A. Pink; pink
    B. Purple; colorless
    C. Purple; pink
    D. Purple; purple

17. Which of the following is the major reason why it has been difficult to treat viral infections with chemotherapeutic agents?
    A. Viruses resemble their hosts and therefore offer no selective point of attack.
    B. Viruses use the metabolic machinery of their hosts, which limits many of the potential points of attack.
    C. Viruses have no metabolism and therefore offer no selective point of attack.
    D. Actually, viruses are not difficult to treat with chemotherapeutic agents.

18. Which of the following features is most likely to be associated with a lithotroph?
    A. Contains chlorophyll
    B. Oxidizes hydrogen sulfide to sulfate
    C. Ferments carbohydrates
    D. Luminescence

19. The type II protein secretion pathway of bacteria
    A. Plays a key role in directing proteins to the periplasm.
    B. Is also known as the ABC protein secretion pathway and secreted proteins usually have a C-terminal secretion signal.
    C. Directs secretion of some proteins from the periplasm across the outer membrane.
    D. Functions by transporting flagellum proteins to their extracellular site of assembly.

20. The most efficient mechanism of gene transfer between *E. coli* cells is
    A. Generalized transduction.
    B. Transformation.
    C. Transposition.
    D. Hfr × F^- conjugation.

21. Which of the following is not true of viroids?
    A. Viroids are small circular ssRNA molecules.
    B. Viroids have no protein capsids.
    C. Viroid RNA does not serve as mRNA nor does it direct the synthesis of mRNA.
    D. Extracellular viroids have a lipid bilayer envelope.

22. Which of the following is not usually true about RNA bacteriophages?
    A. The genome RNA is plus-stranded and can act as mRNA.
    B. The genome RNA is converted to double-stranded RNA before replication.
    C. The RNA replicase enzyme of the host is used to produce copies of the phage genome.
    D. In addition to ssRNA phages, dsRNA phage also exists.

23. An F' plasmid results when
    A. An F+ × F- mating is interrupted before completion.
    B. An Hfr × F- mating is interrupted before completion.
    C. An integrated F plasmid is incorrectly excised, bringing host genes with it.
    D. None of the above

24. Differences between mitochondrial and *E. coli* electron transport chains include the following:
    A. The *E. coli* chain is branched and contains a different array of cytochromes.
    B. The fundamental principles on which they operate are different.
    C. Mitochondrial electron transport chains lack iron sulphur proteins.
    D. *E. coli* electron transport chains lack iron sulphur proteins.

25. Immersion oil can be used to increase the resolution achieved with some microscope lenses because it increases the _____ between the specimen and the objective lens.
    A. Optical density
    B. Refractive index
    C. Optical density and refractive index
    D. Neither optical density nor refractive index

26. Nonenveloped viruses gain access to Eukaryotic host cells by
    A. Fusion with the host cell plasma membrane followed by entrance of the nucleocapsid into the cytoplasm.
    B. Endocytosis
    C. Pinocytosis
    D. Nucleic acid injection through a transmembrane injection tube.

27. 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 culture enters stationary phase with a population of 65 million cells. At what time is the population half maximal?
    A. 6:30 p.m
    B. 7:20 p.m
    C. 8:20 p.m
    D. 8:40 p.m

28. The Ames test
    A. can be used to measure the mutagenicity of chemicals.
    B. is used to measure the repair of thymine dimers.
    C. is used to measure levels of oxygen free radicals.
    D. none of the above

29. In which of the following types of procaryotes have split genes been found?
    A. Bacteria
    B. Cyanobacteria
    C. Archaea
    D. None of these

30. The principle of transformation was first demonstrated by which of the following individuals or groups of individuals?
    A. Avery, MacLeod, and McCarty
    B. Griffith
    C. Hershey and Chase
    D. Watson and Crick

Short answers (簡答題 或 解釋名詞): please define or briefly explain the following terms (3 points for each; total 18 points)

1. LD_{50}
2. Superantigens
3. A pathogenic island
4. Psychrophile
5. Icosahedral capsid
6. Fimbria

Long answers (問答題): answer each of the following questions (total 52 points)

1. Please describe the difference between the general properties of exotoxins and endotoxins (6%)

2. What is respiratory burst (4%)? Please explain the relationship between the respiratory burst and phagocytosis (6%)

3. What is the bacterial type III secretion system (4%)? Using *Yersinia* spp. as an example, please describe how the type III secretion system can participate in bacterial virulence (6%)

4. Lambda phage is a double-stranded DNA phage which can establish two different relationships (lysogenic and lytic) with its host cells. Please describe the involvement of the lambda repressor, cro protein, the recA protein, integrase, and excisionase in lysogeny and induction (beginning of the lytic cycle). (10%)

5. What is the definition of decimal reduction time (**D value**)? What is the meaning of the ***z* value**? Suppose that you wanted to eliminate the risk of *Salmonella* poisoning by heating your food sample (D_{60} = 0.4 minutes, z value = 5.0℃). How long would it take to reduce a population of 10^{12} *Salmonella* to 10^{0} at 60℃? How long would it take to achieve the same results by heating at 55 and 65℃? (8%)

6. Compare in detail the composition and structure of gram-positive cell walls with those of gram-negative cell walls. Include labeled diagrams in the answer. Also, design an experiment to demonstrate the importance of the cell wall in protecting bacteria against osmotic lysis. (8%)