國　立　清　華　大　學　命　題　紙

98 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__6__頁第_1__頁 *請在【答案卷】內作答

I. Single choice (單選題, 2 points each, total 40%)

1. An immune complex resulting from an interaction of antibody with cells or particles which becomes large enough to settle out of solution is called a (n)
   A. Agglutination reaction.
   B. Precipitation reaction.
   C. Hemagglutination.
   D. Ouchterlony double diffusion.
   E. All of choices.

2. A vaccination is a good example of
   A. Naturally acquired passive immunity.
   B. Naturally acquired active immunity.
   C. Artificially acquired active immunity.
   D. Artificially acquired passive immunity.
   E. All of choices.

3. With respect to orthomyxoviruses, changes in antigenicity usually occur as a result of
   A. Antigenic drift.
   B. Antigenic shift.
   C. Frameshift mutations.
   D. Both antigenic drift and antigenic shift
   E. Both antigenic drift and frameshift mutations

4. The Ebola virus causes
   A. Encephalitis.
   B. Pulmonary syndrome.
   C. Hemorrhagic fever.
   D. Lassa fever.
   E. Hay fever.

5. In influenza virus, antigenic shift
   A. Results from reassortment of genomes when two different strains of flu viruses infect the same cell.
   B. Results from the accumulation of mutations in HA and NA in a single strain of flu virus.
   C. Can result in major epidemics or pandemics.
   D. Results from reassortment of genomes when two different strains of flu viruses infect the same cell and can result in major epidemics or pandemics.
   E. None of choices.

6. Which of the following is a disease of humans that is probably caused by a prion and was originally associated with cannibalism?
   A. Scrapie.
   B. Creutzfeld-Jakob Disease.
   C. Kuru.
   D. Scrapie and Creutzfeld-Jakob Disease.
   E. Both scrapie and Kuru.

7. The protein coat surrounding the viral genome is called the
   A. Capsule.
   B. Capsid.
   C. Matrix.
   D. Envelope.
   E. Spike.

8. The two major types of symmetry found in viruses are
   A. Icosahedral and radial.
   B. Icosahedral and helical.
   C. Helical and radial.
   D. Radial and bilateral.
   E. Icosahedral and bilateral.

9. Organisms that grow well at 0°C and have optimum growth temperatures between 20°C and 30°C are called
   A. Hyperthermophiles.
   B. Psychrotrophs.
   C. Mesophiles.
   D. Thermophiles.
   E. Frigiphiles.

10. Which of the following is true about bacteria?
    A. Bacteria have a membrane-bound structure called nucleoid.
    B. The size of a bacterial ribosome is 80S.
    C. Some of bacteria have an actin-like protein called MreB which plays an important role in cytokinesis.
    D. The membranes in bacteria contain cholesterol.
    E. Some of bacteria have fimbriae for mating (conjugation).

11. Mannitol salt agar (MSA) only allows the growth of halophiles. Among the halophiles, mannitol fermenters release acid that turns the pH indicator yellow; mannitol nonfermenters leave the medium red. Onto MSA you inoculate a halophilic mannitol nonfermenter and a nonhalophilic mannitol nonfermenter. Here the medium acts as a _____ medium.
    A. General purpose.
    B. Differential.
    C. Selective and differential.
    D. Enrichment.
    E. Selective.

12. An F' plasmid results when
    A. An integrated F plasmid is incorrectly excised, bringing host genes with it.
    B. An $F^+ \times F^-$ mating is interrupted before completion.
    C. An Hfr $\times$ F^- mating is interrupted before completion.
    D. None of the above is correct.
    E. All of the above are correct.

13. Which of the following is not used as a means used by bacteria to increase cell number:
    A. Fragmentation of filaments into hormogonia.
    B. Budding.
    C. Formation of exospores.
    D. Formation of endospores.
    E. Binary fission.

14. Which of the following is not true about insertion sequences?
   A. Can move around the chromosomes within an organism.
   B. Are relatively short (750 to 1,600 bp).
   C. Contain only one gene encoding transposase.
   D. Are discrete genetic elements with direct repeats at their ends.
   E. A re widespread in bacteria, eukaryotes and archaea.

15. Which of the following statement is not true?
   A. Opportunistic pathogen is an organism that is part of the host's normal flora, but can cause disease when the host is immunocompromised.
   B. In many bacterial pathogens, pathogenicity islands represent segments of DNA that carry genes encoding major virulence factors.
   C. Bacterial endotoxins are heat sensitive, but exotoxins are heat stable to 250°C.
   D. The toxic component of bacterial endotoxins is the lipid portion, called lipid A.
   E. The enzymatic subunit (A) of bacterial AB toxins is responsible for the toxic effect. once inside the host cell, whereas the binding subunit (B) can bind to the target cells.

16. Which is not true for tuberculosis (TB)?
   A. Mycobacterium tuberculosis (Mtb) is one of the causative agents for TB.
   B. The cell envelope of Mtb contains several unique lipids and glycolipids (such as mycolic acids) that are directly toxic to host cells
   C. Formation of tubercles is characteristic of tuberculosis and give the disease its name.
   D. Both gram staining and acid-fast stain can be used for the identification of Mtb.
   E. Transmission of tuberculosis to humans from susceptible animal species and their products is possible.

17. Which of the following is <u>not true</u> for Mycoplasmas?
   A. Mycoplasmas form endospores, which are resistant to high heat.
   B. Mycoplasmas lack a cell wall and peptidoglycan precursors.
   C. The cell can be filamentous and form branches.
   D. The cells use budding in their reproduction.
   E. Most of them are not motile.

18. Which one of the followings has not been used to evade host defense by bacteria?
   A. Serum resistance.
   B. Bacterial intoxications.
   C. Bacterial capsules.
   D. Lengthened O-chains in lipoposaccharides.
   E. None of the above.

19. Which is not true for the comparison of bacteria, archaea and eucarya?
   A. The *Archaea* lack membrane-enclosed nucleus with nucleolus.
   B. The *Archaea* have ether-linked, branched aliphatic chains in their membrane lipid.
   C. Messenger RNA splicing and capping are absent in the *bacteria*.
   D. The cell wall of the *Archaea* contains muramic acid.
   E. The *Eucarya* are insensitive to Rifampicin, which inhibits DNA-dependent RNA polymerase

20. Which is not true for the purple bacteria, the green bacteria and the cyanobacteria?
   A. These bacteria are three groups of gram-negative photosynthetic bacteria.
   B. The cyanobacteria different most fundamentally from the green and purple bacteria is being able to perform anoxygenic photosynthesis.
   C. The cyanobacteria contain photosystems I and II, use water as an electron donor and generate oxygen during photosynthesis.
   D. The green and purple bacteria have only one photosystem.
   E. The green and purple bacteria can use hydrosulfide, sulfur or hydrogen as an electron source.

II. Term description (14%)
1. Facultative anaerobe (3%)
2. Chemolithotropic autotroph (3%)
3. ***E. coli***: what is the ***E*** stands for? (4 %)
4. Biofilms (4 %)

III. Long answers (Total 46%)
1. How the *lentivirus* replicates in the cells? (10%)
2. Please draw the structure of avian influenza virus and also label the name of avian influenza viral proteins. (10%)
3. Briefly describe how dark-field and epifluorescence microscopes work and the kind of image provided by each. Also, give a specific use for each type. (6%)

4. Define the generation (or doubling) time and the mean growth rate constant. (4%) Calculate the mean growth rate constant and generation time of a culture that increase in the log phase from 1×10^3 to 1×10^9 in 13 hours. ($\log 2 = 0.301$) (4%)
5. Some pathogenic bacteria can secrete toxins, called hemolysins. When these bacterial colonies are grown on blood agar, the erythrocyte lysis (hemolysis) can be observed. What are the differences between alpha-hemolysis and beta-hemolysis? (6 %)
6. A genomic comparison was conducted between an *E. coli* virulent strain O157:H7 and an *E. coli* non-pathogenic strain K-12. The results indicated that a 1.34 Mb DNA segment (called a pathogenicity island) is only existed in the chromosome of O157:H7, but not in K-12. Please indicate any one of the common characteristics for such a pathogenicity island (2 %). Please explain how such a comparative genomic analysis may help us to develop a new treatment method or a new vaccine for a disease caused by bacterial infection. (4 %)