東吳大學 112 學年度碩士班研究生招生考試試題

系級	微生物學系碩士班	考試時間	100 分鐘
科目	基礎微生物學	本科總分	100 分

※一律作答於答案卷上(題上作答不予計分)；並務必標明題號，依序作答

I. Explain the keywords（名詞解釋; 4 points for each keyword）

1. CRISPR/Cas
2. microbiome
3. COVID-19
4. brain-gut axis
5. probiotics
6. microorganism

II. Multiple Choice (單選題; 2 points for each question)

1. Capsule staining is a difficult method to perform since
   a. capsules are antigenic.
   b. capsular materials are water-soluble.
   c. capsules repel most natural dyes.
   d. the specimen has to be mixed with fine colloidal suspension of India ink or nigrosin.

2. Which of the following is not a distinctive feature of prokaryotic cells?
   a. They usually have a single, circular chromosome.
   b. They lack a plasma membrane.
   c. They have cell walls containing peptidoglycan.
   d. They have a 50S subunit of the ribosome.

3. Regarding anaerobic respiration, which of the following is correct?
   a. The final electron acceptor is always an organic molecule.
   b. The final electron acceptor is molecular oxygen.
   c. It generates 58 ATP molecules for each glucose molecule.
   d. Substrate-level phosphorylation and oxidative ATP generation occur.

Use the information below to answer questions 4 and 5. Two culture media were inoculated with four different bacteria. After culturing, the following results were obtained:

Organism	**Medium 1**	**Medium 2**
Synechococcus elongatus	No growth	Green colonies
Vibrio cholerae	Growth	No growth
Vibrio fischeri	Growth	No growth
Rhodopseudomonas palustris	No growth	Red colonies

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4. Medium 1 is
   a. selective.
   b. differential.
   c. both selective and differential.

5. Medium 2 is
   a. selective.
   b. differential.
   c. both selective and differential.

6. Which of the following is not suitable for autoclave sterilization?
   a. enzyme solution
   b. pipette tips
   c. lysogeny agar
   d. stainless steel scissors

7. Which of the following statements is true for beta-galactosidase?
   a. It is a protein encoded by the *lacZ* gene.
   b. It is a gene on the *lac* operon
   c. It is one of the enzymes needed to metabolize lactose.
   d. Both a and c.

8. The DNA primer, 3′-CCATGC, will hybridize with which of the following?
   a. 5′-GGTACG
   b. 5′-CCATGC
   c. 5′-GGCTTA
   d. 3′-CCATGC

9. Which of the following shows a descending order of taxonomic hierarchy?
   a. domain, kingdom, phylum, class, order, family, species, genus
   b. kingdom, domain, phylum, class, order, family, genus, species
   c. domain, kingdom, phylum, class, order, family, genus, species
   d. domain, phylum, kingdom, class, order, family, genus, species

10. The rise in herd immunity in a population can be directly attributed to
    a. the increased use of antibiotics.
    b. improved handwashing.
    c. vaccinations.
    d. antibiotic-resistant microorganisms.

11. All of the following are iron-binding proteins found in humans and play an integral role in innate

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immunity, except
a. lactoferrin.
b. ferritin.
c. hemoglobin.
d. siderophores.

12. Chloramphenicol binds to the 50S part of the ribosome and interferes with
a. transcription in prokaryotic cells.
b. transcription in eukaryotic cells.
c. translation in prokaryotic cells.
d. DNA synthesis.

For questions 13-16, answer whether
a. the amount of oxygen doesn't make any difference.
b. the process takes place under anaerobic conditions.
c. the process takes place under aerobic conditions.

13. Activate sludge system.
14. Denitrification.
15. Nitrogen fixation.
16. Methane production.

17. Which of the following reactions are carried out by microorganisms in the winemaking process?
a. sugar ➔ CO_2 +H_2O
b. sugar ➔ ethanol
c. carbon dioxide ➔ sucrose
d. malic acid ➔ lactic acid

18. In an agglutination test, ten serial dilutions to determine antibody titer were set up. Tube 1 contained a 1:2 dilution; tube 2, a 1:4, and so on. If tube 8 is the last tube showing agglutination, what is the antibody titer?
a. 256
b. 128
c. 1:128
d. 1:256

III. Short-answer question（簡答題; 10 points for each question）

1. Draw the bacterial shapes listed in (a), (b), (c), (d) and (e).
a. spiral; b. bacillus; c. coccus; d. staphylococci, e. streptobacilli

2. Use the additional information below to construct a cladogram (親緣圖).

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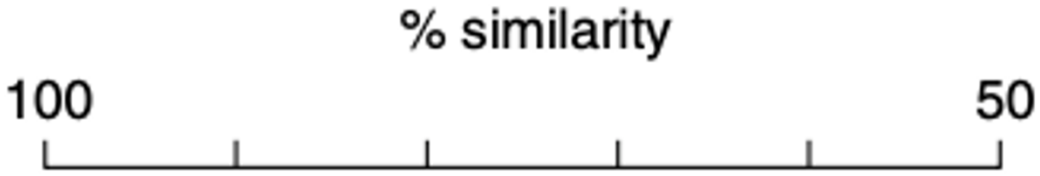
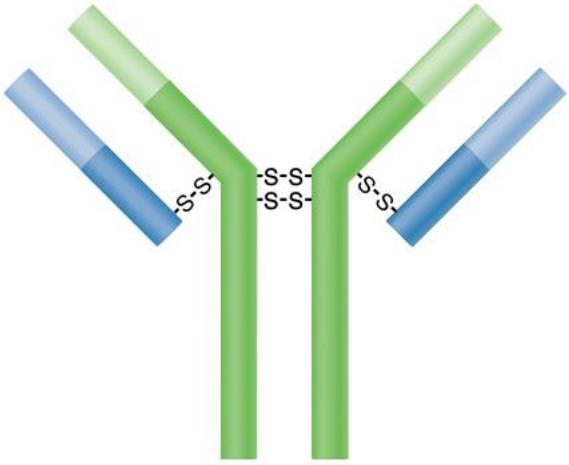
Pair of species	Similarity in 16S rRNA gene
A - B	55%
A - C	55%
A - D	82%
B - C	75%
B - D	55%
D - C	55%



3. Mark the heavy chain, light chain, variable region and Fc region of typical antibodies. Indicate where the antibody binds to the antigen. Draw an IgM antibody.



4. Please descript microbial activities on the production and consumption of greenhouse gases (CO_2; CH_4; N_2O).