

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

一、單選題 (Simple choice question)：20 題，每題 2 分

1. The sequence of letters 'KDTY' will represent
 - a. Lysine, aspartic acid, threonine, tyrosine
 - b. Tryptophan, asparagine, tyrosine, tryptophan
 - c. Threonine, lysine, tryptophan, asparagine
 - d. Tyrosine, glutamine, tryptophan, lysine
2. The torsion angles of N-C_α bond and C_α-C_o bond in a peptide bond are denoted
 - a. α & β
 - b. ϵ & δ
 - c. ϕ & ψ
 - d. τ & ω
3. Fatty acid synthesis takes place in
 - a. Mitochondria
 - b. Cell membrane
 - c. Cytosol
 - d. Endoplasmic reticulum
4. In what form does the product of glycolysis enter the TCA cycle?
 - a. Acetyl-CoA
 - b. Pyruvate
 - c. NADH
 - d. Glucose
5. Which pair of amino acids absorbs the most UV light at 280 nm?
 - a. Cysteine & Asparagine
 - b. Threonine & Histidine
 - c. Phenylalanine & Proline
 - d. Tryptophan & Tyrosine
6. A competitive inhibitor has the following effect on an enzyme-catalyzed reaction.
 - a. It changes the V_{max} .
 - b. It changes the K_m .
 - c. It changes both V_{max} and K_m .
 - d. It has no effect on the V_{max} and K_m .
7. In the regulation of TCA (Tricarboxylic Acid Cycle) cycle, which of the following statements is **false**?
 - a. Pyruvate dehydrogenase is inhibited by NADH.

- b. Pyruvate dehydrogenase is inhibited by ATP.
 - c. Citrate synthase is inhibited by NADH.
 - d. Succinyl-CoA activates citrate synthase.
8. Which statement is most likely to be true concerning obligate anaerobes?
- a. These organisms can use oxygen if it is present in their environment.
 - b. These organisms cannot use oxygen as their final electron acceptor.
 - c. These organisms carry out fermentation for at least 50% of their ATP production.
 - d. Most of these organisms are vegetative fungi.
9. The N-linked glycoproteins of eukaryotes usually have a N-acetyl glucosamine (NAG) attached to
- a. a surface Gln residue.
 - b. a surface Lys residue.
 - c. a surface Asn residue.
 - d. the amino terminal residue.
10. For every one molecule of sugar glucose which is oxidized, _____ molecules of pyruvic acid are produced.
- a. 2
 - b. 3
 - c. 4
 - d. 5
11. The function of SDS in SDS-PAGE is
- a. to inactivate proteins
 - b. to separate proteins with different molecular weights
 - c. to linearize and neutralize the charged proteins
 - d. to make the proteins separation faster
12. The most suitable chromatography method for separating proteins with different charge densities is
- a. affinity chromatography
 - b. gel permeation chromatography
 - c. ion exchange chromatography
 - d. hydrophobic interaction chromatography
13. Which of the following methods is **not** used to detect gene expression in biological samples?
- a. RT-PCR
 - b. real-time-PCR
 - c. *in situ* hybridization

d. ELISA

14. Which of the following is **not** a prokaryotic expression system?
- Chlamydomonas reinhardtii*
 - Thermus thermophiles*
 - Escherichia coli*
 - Bacillus subtilis*
15. Inorganic nitrogen can be eliminated by using microbes capable of performing anammox reaction. Which of the following is the major product of anammox reaction?
- N₂
 - NO₃⁻
 - NO₂⁻
 - NH₄⁺
16. If you want to detect specific RNA molecules among a mixture of RNA, which technique will you use?
- Southern blotting
 - northern blotting
 - western blotting
 - eastern blotting
17. Which is **not** the target for plant transformation?
- plastid
 - nucleus
 - mitochondria
 - ribosome
18. What is **not** the key factor of the recombinant protein expressed in prokaryotic system?
- inducible promoter
 - post translational modification
 - gene copy number
 - codon usage
19. Which of the following virus is used to transform insect cell line?
- baculovirus
 - retrovirus
 - λ phage
 - picornavirus
20. What is the genome size of *Arabidopsis*?
- 1.3 x 10⁵ bp

b. 1.3×10^6 bp

c. 1.3×10^7 bp

d. 1.3×10^8 bp

二、問答題 (Essay)：共 10 題，60 分

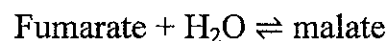
1. (10%) Please describe the function of following proteins.

- a. Serine protease
- b. Flippase
- c. Protein kinase
- d. Hexokinase
- e. Dynein

2. (6%) Please explain what allosteric regulation is, and then give two specific examples.

3. (6%) Please describe how light energy is used to drive the reaction of ATP-synthesis during the photosynthesis process?

4. (8%) The citric acid cycle enzyme fumarase catalyzes the conversion of fumarate to form malate.



The turnover number, k_{cat} , for fumarase is 800/sec. The K_m of fumarase for its substrate fumarate is $5 \mu\text{M}$.

- a. Please describe the meaning of the turnover number, k_{cat} , in enzymology.
- b. In an experiment using 2 nanomole/L of fumarase, what is V_{max} ?
- c. The cellular concentration of fumarate is $47.5 \mu\text{M}$. What is the reaction rate (v) when $[\text{fumarate}] = 47.5 \mu\text{M}$?
- d. What is the catalytic efficiency of fumarase?

5. (5%) Please briefly define liquid and solid-state fermentation.

6. (5%) Why farming fish is more efficient than raising cattle (in terms of feed conversion ratio)?

7. (5%) Briefly describe the monoclonal antibody production protocol.

8. (5%) Briefly describe how to produce cat clones by using nuclear transfer technology.

9. (5%) Briefly describe stages of drug development (or phase trials for drug development).

10. (5%) Please explain why genetically modified organism (GMO) plants made by CRISPR/Cas9 gene editing technology could bypass GMO regulations.