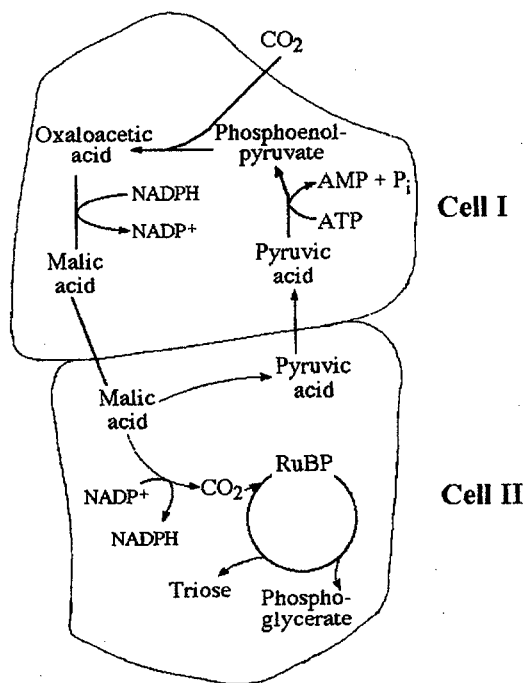


A. 單選題(1~19題)/多選題(20~25題)，每題2分 ※ 本大題請於試卷內之「選擇題作答區」依序作答。

Use the figure to answer the following two questions (1~2).



1. Which of the following statements is true concerning the accompanying figure?

- (A) It represents a C₄ photosynthetic system.
- (B) It represents an adaptation that maximizes photorespiration.
- (C) It represents a C₃ photosynthetic system.
- (D) It represents a CAM photosynthetic system.

2. Referring to the accompanying figure, oxygen would inhibit the CO₂ fixation reactions in _____.

- (A) cell I only
- (B) cell II only
- (C) neither cell I nor cell II
- (D) both cell I and cell II

見背面

3. If photosynthesizing green algae are provided with CO_2 containing heavy oxygen (^{18}O), later analysis will show that all of the following molecules produced by the algae contain ^{18}O EXCEPT _____.
- (A) 3-phosphoglycerate
 - (B) glyceraldehyde 3-phosphate (G3P)
 - (C) glucose
 - (D) O_2
4. Which of the following are products of the light reactions of photosynthesis that are utilized in the Calvin cycle?
- (A) H_2O and O_2
 - (B) ADP, P_i , and NADP^+
 - (C) electrons and H^+
 - (D) ATP and NADPH
5. Why are there several structurally different pigments in the reaction centers of photosystems?
- (A) Excited electrons must pass through several pigments before they can be transferred to electron acceptors of the electron transport chain.
 - (B) This arrangement enables the plant to absorb light energy of a variety of wavelengths.
 - (C) They enable the plant to absorb more photons from light energy, all of which are at the same wavelength.
 - (D) They enable the reaction center to excite electrons to a higher energy level.
6. In mitochondria, chemiosmosis moves protons from the matrix into the intermembrane space, whereas in chloroplasts, chemiosmosis moves protons from the _____.
- (A) matrix to the stroma
 - (B) stroma to lumen
 - (C) intermembrane space to the matrix
 - (D) lumen to the stroma

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7. Which of the following cross-membrane transport mechanisms occur without expenditure of energy?

- (A) channels
- (B) H⁺-ATPases
- (C) symporter
- (D) pump

8. The pressure-flow mechanism for sugar translocation you have learned about in this class is based on research on angiosperms, and thus might not occur in other vascular plants. Which of the following real or hypothetical observations on gymnosperms would suggest they possess a different mechanism?

- (A) Pores in the sieve areas of their sieve-tube members are filled with numerous membranes.
- (B) Gymnosperms do not possess vessels.
- (C) Bidirectional phloem transport occurs in gymnosperms.
- (D) Asymmetric annual growth rings occur in gymnosperms.

9. Which of the following is a similarity between xylem and phloem transport?

- (A) Many cells in both tissues have sieve plates.
- (B) Expenditure of energy from ATP is required.
- (C) Transpiration is required for both processes.
- (D) Bulk flow of water is involved.

10. Irrigation reduces soil quality and rains usually don't. Why?

- (A) Rains deliver less water to soil than irrigation does.
- (B) Water used for irrigation contains fertilizer and pesticides that affect soil quality.
- (C) Rainwater contains less inorganic material.
- (D) The fast water flow during irrigation removes organic material from soil.

11. Substrate-level phosphorylation occurs _____.

- (A) in glycolysis
- (B) in the citric acid cycle
- (C) in both glycolysis and the citric acid cycle
- (D) during oxidative phosphorylation

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12. Which of the following statements about NAD^+ is true?

- (A) NAD^+ is reduced to NADH during glycolysis, pyruvate oxidation, and the citric acid cycle.
- (B) NAD^+ has more chemical energy than NADH.
- (C) NAD^+ can donate electrons for use in oxidative phosphorylation.
- (D) In the absence of NAD^+ , glycolysis can still function.

13. In glycolysis, for each molecule of glucose oxidized to pyruvate _____.

- (A) two molecules of ATP are used and two molecules of ATP are produced.
- (B) two molecules of ATP are used and four molecules of ATP are produced.
- (C) four molecules of ATP are used and two molecules of ATP are produced.
- (D) two molecules of ATP are used and six molecules of ATP are produced.

14. If pyruvate oxidation is blocked, what will happen to the levels of oxaloacetate and citric acid in the citric acid cycle shown in the accompanying figure?

- (A) Oxaloacetate will decrease and citric acid will accumulate.
- (B) Oxaloacetate will accumulate and citric acid will decrease.
- (C) Both oxaloacetate and citric acid will decrease.
- (D) Both oxaloacetate and citric acid will accumulate.

15. The synthesis of ATP by oxidative phosphorylation, using the energy released by movement of protons across the membrane down their electrochemical gradient, is an example of _____.

- (A) active transport
- (B) an endergonic reaction coupled to an exergonic reaction
- (C) a reaction with a positive ΔG
- (D) allosteric regulation

16. The hormone that substitutes for long photoperiod is

- (A) auxin
- (B) cytokinin
- (C) florigen
- (D) gibberellin

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17. In short day plants flowering is induced by:

- (A) long night
- (B) photoperiod less than 12 hours
- (C) photoperiod less than critical and uninterrupted long night
- (D) darkness less than critical and long uninterrupted daylight

18. Which of the following is the motivative force for growth?

- (A) Turgor pressure
- (B) Root pressure
- (C) Osmotic pressure
- (D) Atmospheric pressure

19. Phytochrome is found in:

- (A) Thallophytes
- (B) seed plants
- (C) vascular plants
- (D) whole plant kingdom

20. Which of the following statement regarding phototropism in Arabidopsis is correct?

- (A) Phototropism requires changes in auxin mobilization.
- (B) Two chromophore-binding domains, LOV1 and LOV2, of the phototropin have equal functions involved in phototropism.
- (C) Phototropism occurs only in blue light.
- (D) More than one phototropin act in phototropism in Arabidopsis.

21. Which hormones are involved in the process of Arabidopsis embryogenesis?

- (A) ABA
- (B) auxin
- (C) cytokinin
- (D) ethylene

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22. Which hormones are required for normal vascular development?
- (A) gibberellins
 - (B) cytokinin
 - (C) ABA
 - (D) auxin
23. Which of the following statement regarding vernalization in Arabidopsis is correct?
- (A) The sensor for vernalization is present at the leaves.
 - (B) Vernalization is the process whereby repression of flowering is alleviated by a cold treatment given to a hydrated seed.
 - (C) Vernalization results in an enhancement of *FLC* gene expression.
 - (D) Vernalization can involve epigenetic changes in gene expression.
24. Which of the following statement regarding florigen in Arabidopsis is correct?
- (A) Florigen is a hormone.
 - (B) Florigen is synthesized in leaves.
 - (C) Florigen is transported to the apical meristem via the phloem.
 - (D) Florigen is plant species-specific and not transmittable between species
25. Which of the following statement regarding pollen tube elongation is correct?
- (A) Ca^{2+} is not involved in this process.
 - (B) Pollen tubes grow by tip growth.
 - (C) Pollen tube elongation is guided by the antipodal cells.
 - (D) Reactive oxygen species (ROS) can promote pollen tube elongation.

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B. 問答題 (中、英文回答皆可) ※ 本大題請於試卷內之「非選擇題作答區」標明題號依序作答。

1. 植物也像人類一樣有免疫反應來抵抗蟲害或病害。請問植物如何分別對食草動物(herbivores)與病原菌(pathogen)的攻擊，產生系統性的防禦反應？需寫出遠距離傳遞分子的名稱與之後產生反應的結果。(10分)
2. 有關光合作用，請回答下列問題。(1) 光反應中，有兩個可移動電子傳遞這(mobile electron carriers)，是哪兩個？又哪一個是含銅蛋白？(英文作答需寫完整名稱)；(2) 哪個/些步驟指的是primary photochemical event(s)？即能量從光能轉為化學能。(10分)
3. 何謂「shade avoidance responses」？(4分) 請討論光敏素(phytochromes)與吉貝素(gibberellins)參與調控「shade avoidance responses」的分子機制。(6分)
4. 光週期調控植物開花，何謂「Coincidence model」？(2分)；請以「Coincidence model」討論阿拉伯芥與水稻中開花調控的分子機制。(各4分，共8分)
5. 何謂「MADS-box」基因？(2分)；請討論它們如何調控花器的發育(4分)，以及它們調控番茄果實的發育(2分)和茄紅素累積的分子機制(2分)。

試題隨卷繳回