

本試卷第一至第五大題為必答題，每題 12 分，共 60 分；第六至十五大題為選答題，請選最有把握 5 題作答，每題 8 分共 40 分。選答題如作答超過 5 題，只以最高分的 5 題計分。作答時請標示清楚題號，以免以影響評分。

必答題部份

一、單選題，每題 2 分，共 12 分

1) Studies using *Arabidopsis thaliana* have led to important advances in all of the following *except*

- A) gene mapping.
- B) impact of point mutations on gene function.
- C) gene expression during plant development.
- D) evolutionary history of plants.
- E) how genes potentially interact with other genes.

2) Biofuels are mainly produced by

- A) the breakdown of cell wall biopolymers into sugars that can be fermented.
- B) plants that convert hemicellulose into gasoline.
- C) the genetic engineering of ethanol-generating genes into plants.
- D) transgenic crops that have cell walls containing ethylene.
- E) plants that are easy to grow in arid environments.

3) Classic experiments suggested that a floral stimulus, florigen, could move across a graft from an induced plant to a noninduced plant and trigger flowering. Recent evidence using *Arabidopsis* has recently shown that florigen is probably

- A) a phytochrome molecule that is activated by red light.
- B) a protein that is synthesized in leaves, travels to the shoot apical meristems, and initiates flowering.
- C) a membrane signal that travels through the symplast from leaves to buds.
- D) a second messenger that induces  $Ca^{++}$  ions to change membrane potential.
- E) a transcription factor that controls the activation of florigen-specific genes.

4) Plants are affected by an array of pathogens. Which of the following is a likely plant defense/response against disease?

- A) cells near the point of infection destroying themselves to prevent the spread of the infection
- B) production of chemicals that repel pathogens
- C) transcriptional level recognition followed by production of stress proteins
- D) thickening the cuticle so that pathogens have trouble penetrating the tissues
- E) stopping all xylem and phloem movement within infected tissues

5) What would be a plant adaptation that increases exposure of a plant to light in a dense forest?

- A) closing of the stomata
- B) lateral buds
- C) apical dominance
- D) absence of petioles
- E) intercalary meristems

6) External stimuli would be received most quickly by a plant cell if the receptors for signal transduction were located in the

- A) plasma membrane.
- B) cytoplasmic matrix.
- C) endoplasmic reticulum.
- D) nuclear membrane.
- E) nucleoplasm.

二、Taiwan has many mountain areas which are inhabited by many endemic terrestrial vertebrate and plant species. Compare what are the possible outcomes when high and low elevation species response to future trends of climate change? (12 分)

(Consider your answers in aspects such as which direction these plants and animal will migrate if they can, whether their survival will be enhanced or threatened due to the limitation of the new habitats, and would you expect an increase or decrease of endemism?)

三、Albinism in humans is inherited as a simple recessive trait. For the following families, determine the genotypes of the parents and offspring (if two alternative genotypes are possible, list both). (每小題 3 分，共 12 分)

- a. A normal male and an albino female have six kids, all normal.
- b. A normal male and an albino female have six kids, three normal and three albino.
- c. Two normal parents have five kids, four normal and one albino.

四、請比較三種細胞骨架—微管、中間絲與微絲 (microtubules、intermediate filaments、actin filaments) 的組成構造及主要功能。(12 分)

五、

(1) 請扼要解釋以下 a-f 名詞 (每小題 1 分，共 6 分)

- a. Nissl bodies      b. Axonal transport      c. Oxytocin      d. Posterior pituitary gland
- e. Action potential      f. Dendrites (of nerve cell)

(2) 請使用上面所有(a-f)名詞，寫成一小段描述神經內分泌功能的短文 (6 分)

選答題部份

六、請解釋以下兩名詞(每小題 4 分，共 8 分)

- 1. Phytoremediation
- 2. Epiphytes

七、請解釋以下兩名詞(每小題 4 分，共 8 分)

- 1. Biological magnification
- 2. Survivorship curves

八、When researchers discovered that a combination of three deletion mutations or three addition mutations would restore the function of a gene, most biologists were convinced that the genetic code was read in triplets. Explain the logic behind this conclusion. (8分)

九、Please describe how plants to prevent self-fertilization and what are the mechanisms of self-incompatibility (8分)

十、Briefly describe possible ways of speciation (4分) and provide examples you know for each speciation mode (4分).

十一、Illustrate the experimental procedure of cloning animals (4分) and explain the logic of cloning animals to test the hypothesis that all cells in the animal body are genetically equivalent (4分).

十二、細胞週期 (cell cycle) 的進行受到一些在細胞內數量與活性會規律變動的分子所調控，請舉實驗證明這些分子的作用。(8分)

十三、市售健康鹽以 KCl 取代部份 NaCl，試問長期食用健康鹽是否會造成細胞外鈉離子、鉀離子濃度改變，為什麼？(4分)。請簡單說明何謂鈉離子通道、鉀離子通道與鈉-鉀幫浦(Na<sup>+</sup>-K<sup>+</sup> pump or Na<sup>+</sup>-K<sup>+</sup>ATPase)，何者與上述有關？(4分)

十四、真核細胞的溶體 (lysosome) 可以分解來自細胞外或細胞內的巨分子以獲得能量。請分別說明細胞外 (extracellular) 與細胞內 (intracellular) 的巨分子進入溶體的途徑。(8分)

十五、何謂等張(isotonic)溶液(2分)，其滲透濃度大約多少？(2分)。以你對人類腎臟功能的理解，我們是否可排洩出比等張(isotonic)溶液更濃或更稀的尿液，為什麼？(4分)

試題隨卷繳回