

一、單選題（請選擇一個最適合的答案；每題 3 分；共計 60 分）

1. Which of the following descriptions is **incorrect** about DNA?
  - (A) double helix.
  - (B) composed of two parallel polynucleotides.
  - (C) A pairs with T and G pairs with C.
  - (D) mostly in B form.
  - (E) highly soluble in water.
  
2. A phospholipid is composed of
  - (A) one glycerol molecule linked to three fatty acid molecules.
  - (B) one fatty acid molecule linked to three glycerol molecules.
  - (C) one glycerol molecule linked to three phosphate groups.
  - (D) one fatty acid molecule linked to one glycerol molecule and two phosphate groups.
  - (E) one glycerol molecule linked to one phosphate group and two fatty acid molecules.
  
3. A drug is tested in the laboratory and is found to create holes in both mitochondrial membranes. Scientists suspect that the drug can be harmful to human cells because it can inhibit
  - (i) glycolysis.
  - (ii) the citric acid cycle.
  - (iii) oxidative phosphorylation.

(A) i (B) ii (C) i and ii (D) ii and iii (E) i, ii, and iii.
  
4. Energy can be released from a pigment with an excited electron
  - (A) as heat.
  - (B) as light.
  - (C) by emitting photons, as in fluorescence.
  - (D) All of the choices are correct.
  - (E) None of the choices are correct.
  
5. What is the expected phenotypic ratio of the following cross:  $AaBb \times AaBb$ ? In this example A is dominant to a and B is dominant to b?
  - (A) 16:0:0:0
  - (B) 8:4:2:2
  - (C) 4:4:4:4
  - (D) 1:1:1:1
  - (E) 9:3:3:1
  
6. Multiple origins of replication on the DNA molecules of eukaryotic cells serve to
  - (A) remove errors in DNA replication.
  - (B) create multiple copies of the DNA molecule at the same time.
  - (C) shorten the time necessary for DNA replication.
  - (D) reduce the number of "bubbles" that occur in the DNA molecule during replication.
  - (E) assure the correct orientation of the two strands in the newly growing double helix.

參考用

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7. The first step in initiating eukaryotic gene transcription is the binding of activators to DNA sequences called \_\_\_\_\_.
- (A) operator.
  - (B) enhancer.
  - (C) promoter.
  - (D) repressor.
  - (E) splicer.
8. The type of plant vascular tissue specialized to conduct sugars and other metabolic products is called
- (A) phloem.
  - (B) parenchyma.
  - (C) collenchyma.
  - (D) xylem.
  - (E) sclerenchyma.
9. Which of the sequence for life evolution is correct:
- (A) Prokaryotes → single-celled eukaryotes → multicellular eukaryotes → animal → land plant → human
  - (B) Prokaryotes → single-celled eukaryotes → multicellular eukaryotes → land plant → animal → human
  - (C) Prokaryotes → single-celled eukaryotes → multicellular eukaryotes → animal → human → land plant
  - (D) Prokaryotes → Single-celled and multicellular eukaryotes → animal → land plant → human
  - (E) none of above
10. A mountain range divides a freshwater snail species into two isolated populations. Erosion eventually lowers the range and brings the two populations together again, but when they mate, the resulting hybrids all produce sterile young. This scenario is an example of
- (A) sympatric speciation.
  - (B) allopatric speciation.
  - (C) incipient speciation.
  - (D) gradualism.
  - (E) punctuated equilibrium.
11. During which phase of the heartbeat does the heart fill with blood?
- (A) interphase.
  - (B) resting phase.
  - (C) diastole.
  - (D) atrial phase.
  - (E) systole.
12. Which of the following is *not* a type of connective tissue?
- (A) blood.
  - (B) adipose.
  - (C) plasma.
  - (D) bone.
  - (E) cartilage.

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13. During transmission across a typical chemical synapse,
- (A) neurotransmitter molecules are stored in the synaptic knob.
  - (B) action potentials trigger chemical changes that make the synaptic vesicles fuse with each other.
  - (C) vesicles containing neurotransmitter diffuse to the receiving cell's plasma membrane.
  - (D) neurotransmitter molecules bind to receptors in the receiving cell's plasma membrane.
  - (E) the binding of neurotransmitters to receptors initiates exocytosis.
- 14 Which of the following mobilizes our nonspecific defense system?
- (A) active immunity.
  - (B) inflammation.
  - (C) passive immunity.
  - (D) mobilization of erythrocytes to the affected site.
  - (E) cell-mediated immunity.
15. All of the following are characteristics of eukaryotic chromatin EXCEPT
- (A) five histones each with large amounts of lysine and arginine.
  - (B) DNA wound around a protein core.
  - (C) looped or folded domains.
  - (D) a small nucleoid in the centre.
  - (E) nucleosomes connected by stretches of DNA.
16. Which of the following organs performs the greatest number of functions?
- (A) spleen.
  - (B) kidney.
  - (C) liver.
  - (D) pancreas.
  - (E) gallbladder.
17. A eutrophic aquatic system is one where
- (A) plankton is at very low density.
  - (B) there is high productivity.
  - (C) plants die due to lack of nutrients.
  - (D) the biomass is steadily decreasing.
  - (E) there is no input of phosphate and sodium detergents.
18. Much research is being done to increase the nitrogen-fixing ability of plants with root nodules. Why is this an important goal for agricultural researchers?
- (A) Nitrogen is an essential component of amino acids used to form protein.
  - (B) Plants with improved nitrogen fixation will be able to make more efficient use of expensive fertilizers.
  - (C) By removing the bacteria from the root nodules, more fixed nitrogen will be available to the plant.
  - (D) Decreasing the size of nodules will allow plants to fix more nitrogen into their own molecules.
  - (E) Increasing the nitrogen-fixing ability of nodule bacteria will allow them to make better use of nitrogen fertilizers.

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19. Which one of the following is *not* characteristic of the chaparral biome?
- (A) dense, spiny shrubs with tough evergreen leaves.
  - (B) low amounts of rainfall at unpredictable periods throughout the year.
  - (C) vegetation adapted to periodic fires.
  - (D) many plants with seeds that need fire to germinate.
  - (E) animals include deer, fruit-eating birds, seed-eating rodents, lizards, and snakes.
20. If the owl species is the major factor controlling rabbit populations, which of the following population effects could be expected in this rabbit-owl pair?
- (A) A fall in the owl population should cause a fall in the rabbit population.
  - (B) A fall in the rabbit population should cause an increase in the owl population.
  - (C) An increase in the incidence of disease in the rabbit population should not change the owl population.
  - (D) An increase in the rabbits' food supply should not change the owl population.
  - (E) An increase in the owl population should cause a fall in the rabbit population.

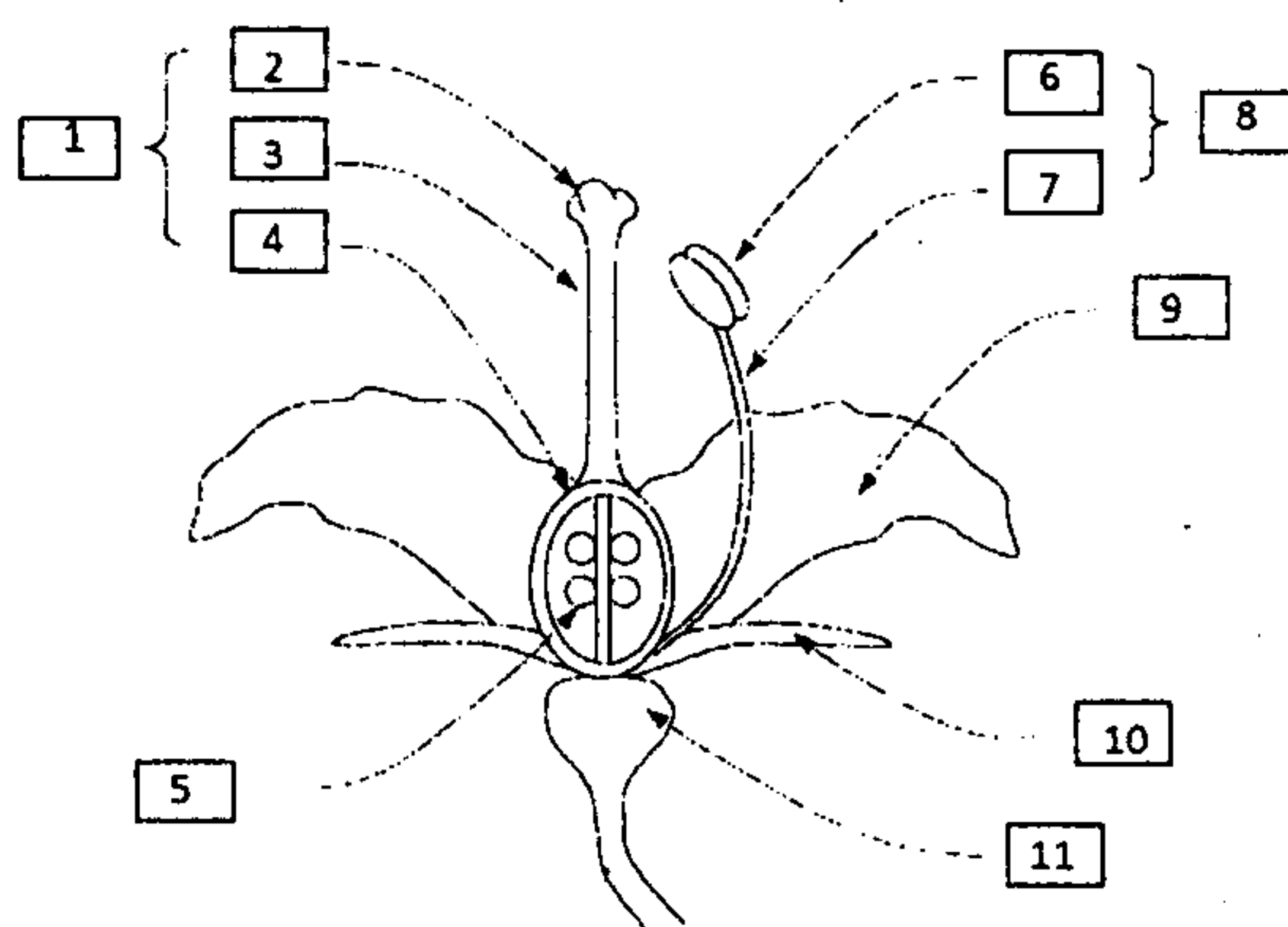
二、簡答題 (共計 40 分)

1. Define the following terms. (10 points; 2 points for each question)

- (A) Sister chromatid.
- (B) Nondisjunction.
- (C) Metastasis.
- (D) Chiasma.
- (E) Polymerase chain reaction (PCR).

2. How do mitochondria, smooth endoplasmic reticulum, and cytoskeleton contribute to the contraction of a muscle cell? (9 points)

3. Please match the numbers in the boxes with letters representing the correct terms. (11 points; 1 point for each box).



- A. Anther
- B. Carpel
- C. Filament
- D. Ovary
- E. Ovule
- F. Petal
- G. Receptacle
- H. Sepal
- I. Stamen
- J. Stigma
- K. Style

4. Please describe the roles of plant hormones on regulation of apical dominance and guard cell opening/closing? (10 points)

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