

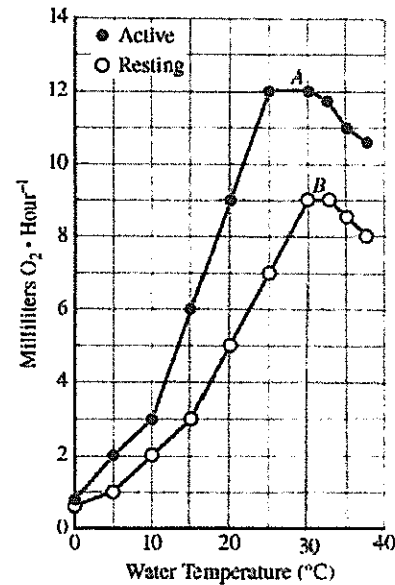
一、單選題 (每題2分, 60%) ※ 本大題請於試卷內之「選擇題作答區」依序作答。

- Which of the following is NOT a characteristic of all three types of protists?  
(A) Eukaryotic (B) Mostly unicellular (C) Mostly aquatic  
(D) Heterotrophic (E) Contain a nucleus
- Blood fibrinogen is converted into fibrin during  
(A) CO<sub>2</sub> transport (B) Oxygen transport (C) An immune response  
(D) Glucose regulation (E) Clot formation
- All of the following are found in vertebrate smooth muscle EXCEPT  
(A) thin filaments (B) thick filaments (C) tropomyosin  
(D) sarcomeres (E) gap junctions
- Zinc is an important plant nutrient primarily because it is associated with  
(A) nucleic acids (B) enzymes (C) ionic balance  
(D) the primary structure of proteins (E) the active site of the chlorophyll molecule
- When transported out of the phloem, sucrose is converted to starch by which of the following organelles in root cells?  
(A) Vacuoles (B) Lysosomes (C) Peroxisomes  
(D) Mitochondria (E) Plastids
- Under aerobic conditions, some blue-green bacteria (cyanobacteria) reduces atmospheric nitrogen in  
(A) Akinetes (B) hormogonia (C) endospores  
(D) Exospores (E) heterocysts
- In pollen of flowering plants, two sperm are formed by  
(A) the first meiotic division (B) the second meiotic division (C) mitosis of a haploid cell  
(D) mitosis of a diploid cell (E) fusion of gametes
- With respect to human height, the production of short individuals by two average-sized parents is best explained by  
(A) mutation (B) sex linkage (C) polygenic inheritance  
(D) epistasis (E) discontinuous variation
- Why are red algae and brown algae able to live at greater depths in the ocean than other algae? Because  
(A) they prefer cold temperatures  
(B) they are heterotrophic  
(C) their accessory pigments absorb red light  
(D) their accessory pigments absorb blue and green light  
(E) they have chlorophyll b
- Most of the neurons in the human central nervous system are \_\_\_\_\_.  
(A) sensory neurons (B) motor neurons (C) interneurons  
(D) peripheral neurons (E) astrocytes

Questions 11-13 refer to the following experiment.

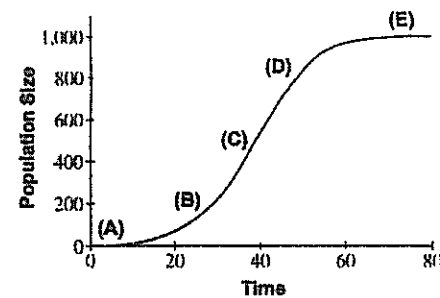
The graph below shows the metabolic rate of a small fish over a wide range of water temperatures while the fish is swimming at maximal sustainable speed (curve A) and while at rest (curve B).

11. At which of the following water temperatures is the resting metabolism of the fish maximal?  
 (A) 0°C (B) 10°C (C) 20°C (D) 30°C (E) 40°C
12. Endurance is often related to the amount by which metabolic rate can be elevated. On the basis of this assumption, at what temperature would the fish be expected to have the greatest endurance?  
 (A) 5°C (B) 15°C (C) 25°C (D) 30°C (E) 35°C
13. The Q10 for resting metabolism between 10 and 20 is  
 (A) 2.0 (B) 3.0  
 (C) less than for active metabolism between 10°C and 20°C  
 (D) the same as for active metabolism between 10°C and 20°C  
 (E) the same as for resting metabolism between 30°C and 35°C



Questions 14-16 refer to the following graph.

14. Rate of population growth is highest.
15. Per capita growth rate is highest.
16. Both population and per capita growth rates are positive but decelerating.



17. Which of the following is the mechanism of post-transcriptional regulation of gene expression.  
 I. RNA interference. II. Alternative splicing. III. Histone modification.  
 IV. miRNA-mediated gene silencing V. DNA methylation.  
 (A) I, II, III (B) II, IV (C) I, II, IV, (D) I, II, IV, V (E) I, II, III, IV, V
18. A signal peptide \_\_\_\_\_.  
 (A) terminates translation of messenger RNA  
 (B) helps target a protein to the ER  
 (C) directs an mRNA molecule into the cisternal space of the ER  
 (D) signals the initiation of transcription  
 (E) can enter into mitochondria
19. The only vertebrates in which blood flows directly from respiratory organs to body tissues without first returning to the heart are the \_\_\_\_\_.  
 (A) amphibians (B) fishes (C) mammals  
 (D) reptiles (E) none of above

20. Which of the following defines a genome?
- (A) representation of a complete set of a cell's polypeptides
  - (B) the complete set of an organism's polypeptides
  - (C) the complete set of a species' polypeptides
  - (D) a karyotype
  - (E) the complete set of an organism's genes
21. Fat digestion yields fatty acids and glycerol, whereas protein digestion yields amino acids; both digestive processes \_\_\_\_\_.
- (A) are catalyzed by the same enzyme
  - (B) use water molecules when breaking bonds (hydrolysis)
  - (C) require the presence of hydrochloric acid to lower the pH
  - (D) require adenosine triphosphate (ATP) as an energy source
  - (E) none of above
22. Animals have adapted different mechanisms for excreting nitrogenous waste products. Which of the following are selective pressures that likely influence which mechanism an animal uses?
- I. the amount of water available in the animal's habitat
  - II. the energy needs of the animal
  - III. the temperature of the animal's environment
- (A) only I                                      (B) only I and III                                      (C) only II and III  
(D) only I and II                                      (E) I, II, and III
23. Egg laying in fruit flies can be triggered (induced) when males deposit their sperm in the spermathecae of the females. What is the selective advantage of induced egg laying for the male flies?
- (A) Because egg laying is induced upon mating, the males do not have to produce as much sperm.
  - (B) More eggs can be fertilized at once when egg laying is induced.
  - (C) Induced egg laying ensures that a male fly's sperm is used for fertilization.
  - (D) Mating takes less time, so less energy is expended by the males.
  - (E) all of above
24. In a Hardy-Weinberg population with two alleles, A and a, that are in equilibrium, the frequency of allele a is 0.2. What is the frequency of individuals that are heterozygous for this allele?
- (A) 0.020                      (B) 0.04                      (C) 0.16                      (D) 0.32                      (E) 0.64
25. Mucus occurs in both the respiratory and digestive tracts. What is its main immunological function?
- (A) sweeping away debris
  - (B) physically trapping of pathogens
  - (C) destruction of pathogens because it is acidic
  - (D) increasing oxygen absorption
  - (E) increasing humidity

26. Stem cell transplants may someday be used to treat Parkinson's disease. Researchers are hopeful that these cells would alleviate the symptoms of Parkinson's disease by \_\_\_\_\_.
- (A) preventing temporal lobe seizures
  - (B) repairing sites of traumatic brain injury
  - (C) replenishing missing ion channels
  - (D) secreting the neurotransmitter dopamine
  - (E) all of above
27. Which of the following statements about apoptosis is true?
- (A) Apoptosis typically involves only a single signaling pathway.
  - (B) Apoptosis is essential for normal development of the nervous system.
  - (C) Apoptosis occurs randomly during embryonic development of a nematode.
  - (D) Apoptosis is triggered only by signals from outside the cell.
  - (E) All of the listed responses are correct.
28. Which characteristic is shared by cnidarians and flatworms?
- (A) dorsoventrally flattened bodies
  - (B) radial symmetry
  - (C) a digestive system with a single opening
  - (D) a distinct head
  - (E) a dorsal nerve cord
29. The term "*homoplasy*" is most applicable to which of the following features?
- (A) the legless condition found in various lineages of extant lizards
  - (B) the five-digit condition of human hands and bat wings
  - (C) the fur that covers Australian moles and North American moles
  - (D) the bones of bat forelimbs and the bones of bird forelimbs
  - (E) all of above
30. The velocity of blood flow is the lowest in capillaries because \_\_\_\_\_.
- (A) the capillaries have internal valves that slow the flow of blood
  - (B) the diastolic blood pressure is too low to deliver blood to the capillaries at a high flow rate
  - (C) the systemic capillaries are supplied by the left ventricle, which has a lower cardiac output than the right ventricle
  - (D) the total cross-sectional area of the capillaries is greater than the total cross-sectional area of the arteries or any other part of the circulatory system
  - (E) all of above

二、解釋名詞 (每題5分, 40%)

- |                               |                         |
|-------------------------------|-------------------------|
| 1. Quorum sensing             | 6. G-protein            |
| 2. Corpus luteum              | 7. Ketogenesis          |
| 3. Alternation of generations | 8. Endosymbiotic theory |
| 4. Gastrulation               |                         |
| 5. Bottleneck effect          |                         |