

一、單選題 (40 分) ※注意：請於試卷「選擇題作答區」依題號作答。※

- Which bonds are created during the formation of the primary structure of a protein?  
(A) peptide bonds      (B) hydrogen bonds      (C) disulfide bonds  
(D) phosphodiester bonds      (E) A, B, and C
- Which of the following would likely move through the lipid bilayer of a plasma membrane most rapidly?  
(A) glucose      (B) an amino acid      (C) CO<sub>2</sub>      (D) K<sup>+</sup>      (E) starch
- CAM plants keep stomata closed in daytime, thus reducing loss of water. They can do this because they \_\_\_\_\_.  
(A) use photosystems I and II at night      (B) fix CO<sub>2</sub> into sugars in the bundle-sheath cells  
(C) fix CO<sub>2</sub> into pyruvate in the mesophyll cells      (D) fix CO<sub>2</sub> into organic acids during the night  
(E) use the enzyme phosphofructokinase, which outcompetes rubisco for CO<sub>2</sub>
- The formation of a cell plate is beginning across the middle of a cell and nuclei are re-forming at opposite ends of the cell. What kind of cell is this?  
(A) an animal cell in metaphase      (B) an animal cell in telophase  
(C) an animal cell undergoing cytokinesis      (D) a plant cell in metaphase  
(E) a plant cell undergoing cytokinesis
- The enzyme telomerase solves the problem of replication at the ends of linear chromosomes by which method?  
(A) adding a single 5' cap structure that resists degradation by nucleases  
(B) adding numerous short DNA sequences such as TTAGGG, which form a hairpin turn  
(C) causing linear ends of the newly replicated DNA to circularize  
(D) causing specific double strand DNA breaks that result in blunt ends on both strands  
(E) adding numerous GC pairs which resist hydrolysis and maintain chromosome integrity
- Most human-infecting viruses are maintained in the human population only. However, a zoonosis is a disease that is transmitted from other vertebrates to humans, at least sporadically, without requiring viral mutation. Which of the following is the best example of a zoonosis?  
(A) smallpox      (B) herpesvirus      (C) rabies      (D) HIV      (E) hepatitis virus
- Which of the following seals the sticky ends of restriction fragments to make recombinant DNA?  
(A) restriction enzymes      (B) DNA ligase      (C) DNA polymerase  
(D) histone acetyltransferase      (E) reverse transcriptase
- What is proteomics?  
(A) the linkage of each gene to a particular protein  
(B) the study of how amino acids are ordered in a protein  
(C) the totality of the functional possibilities of a single protein  
(D) the study of the full protein set encoded by a genome  
(E) the study of how a single gene activates many proteins

9. If neutral variation is truly "neutral," then it should have no effect on \_\_\_\_\_.
- (A) nucleotide diversity      (B) average heterozygosity      (C) gene diversity  
(D) our ability to measure the rate of evolution      (E) relative fitness
10. Which of the following most closely represents the male gametophyte of seed-bearing plants?
- (A) ovule      (B) microspore mother cell      (C) pollen grain interior  
(D) embryo sac      (E) fertilized egg
11. Both fungus-farming ants and their fungi can synthesize the same structural polysaccharide from the beta-glucose. What is this polysaccharide?
- (A) amylopectin      (B) chitin      (C) cellulose      (D) lignin      (E) glycogen
12. Which of these is not considered an amniote?
- (A) amphibians      (B) nonbird reptiles      (C) birds  
(D) egg-laying mammals      (E) placental mammals
13. Which of the following describes the fate of most of the water taken up by a plant?
- (A) It is used as a solvent.      (B) It is used as a hydrogen source in photosynthesis.  
(C) It is used to keep cells turgid.      (D) It makes cell elongation possible.  
(E) It is lost during transpiration.
14. A plant seedling bends toward sunlight because \_\_\_\_\_.
- (A) auxin migrates to the lower part of the stem due to gravity  
(B) there is more auxin on the light side of the stem  
(C) auxin is destroyed more quickly on the dark side of the stem  
(D) auxin is found in greatest abundance on the dark side of the stem  
(E) gibberellins produced at the stem tip cause phototropism
15. Folic acid supplements have become especially important for pregnant women. Why?
- (A) Folic acid deprivation is associated with neural tube abnormalities in a fetus.  
(B) The folic acid stored by pregnant women is removed from their circulation.  
(C) The fetus makes high levels of folic acid.  
(D) Folic acid supplies vitamins that pregnant women lose.  
(E) Folic acid deprivation is a cause of heart abnormalities in a newborn.
16. Which of the following would be described as a portal system?
- (A) an area connecting arterioles to venules  
(B) a series of vessels that returns blood to the heart in an animal with an open circulatory system  
(C) a space within or between organs where blood is allowed to pool  
(D) a slightly muscular vessel that has minimal pumping action in an organism with no heart  
(E) a vessel or vessels connecting two capillary beds
17. B cells interacting with helper T cells are stimulated to differentiate when \_\_\_\_\_.
- (A) B cells produce IgE antibodies      (B) B cells release cytokines  
(C) helper T cells differentiate into cytotoxic T cells      (D) helper T cells release cytokines  
(E) helper T cells present the class II MHC molecule-antigen complex on their surface

18. What would account for increased urine production as a result of drinking alcoholic beverages?  
(A) increased aldosterone production (B) increased blood pressure  
(C) inhibition of antidiuretic hormone secretion (ADH)  
(D) increased reabsorption of water in the proximal tubule  
(E) the osmoregulator cells of the brain increasing their activity
19. Which of the following levels of organization is arranged in the correct sequence from most to least inclusive?  
(A) community, ecosystem, individual, population  
(B) ecosystem, community, population, individual  
(C) population, ecosystem, individual, community  
(D) individual, population, community, ecosystem  
(E) individual, community, population, ecosystem
20. A population's carrying capacity \_\_\_\_\_.  
(A) may change as environmental conditions change  
(B) generally remains constant over time  
(C) increases as the per capita growth rate ( $r$ ) decreases  
(D) can be accurately calculated using the logistic growth model  
(E) can never be exceeded

※下列題目請標明題號，依序作答於試卷內「非選擇題作答區」。可用中文或英文作答※

二、Please explain the following terms. (20%)

1. Genetic drift
2. Inductive reasoning
3. Bioinformatics
4. Reciprocal altruism
5. Ecological niche

三、Please explain the evolutionary origin of eukaryotic mitochondria and the evidence that supports the theory. (10%)

四、Please explain the two laws of Mendel's inheritance. (10%)

五、Please describe the five main conditions that a population must be satisfied to be in Hardy-Weinberg equilibrium. (10%)

六、Please explain why neural transmission only propagates in specific direction. (10%)