※ 本大題請於試卷內之「選擇題作答區」依序作答。

一、單選題（40 分）

1. Which of the following statements is not consistent with Darwin's theory of natural selection?
(A) Natural selection is based in part on the overproduction of offspring.
(B) Natural selection can lead to the appearance of new species.
(C) Individual organisms exhibit genetic change during their life spans to better fit their environment.
(D) Individuals in a population exhibit variations, some of which are heritable.
(E) Factors in the environment result in some organisms with better reproductive success than others.

2. Which of the following is a correct functional group pair?
(A) hydroxyl :: hydrophobic　　(B) methyl :: hydrophilic
(C) sulfhydryl :: hydrophobic　　(D) carbonyl :: hydrophilic
(E) phosphate :: hydrophobic

3. Facilitated diffusion across a biological membrane requires _____ and moves a substance _____ its concentration gradient.
(A) energy and transport proteins . . . against
(B) energy . . . down
(C) energy and transport proteins . . . down
(D) transport proteins . . . against
(E) transport proteins . . . down

4. During which of the following phases of cellular respiration does substrate-level phosphorylation take place?
(A) glycolysis and the citric acid cycle　　(B) priming of pyruvate
(C) oxidative phosphorylation　　(D) the citric acid cycle
(E) glycolysis

5. During which stage of meiosis does synapsis and the formation of tetrads occur?
(A) prophase II　(B) prophase I　(C) interphase I　(D) metaphase I　(E) interphase II

6. A person with AB blood illustrates the principle of _____.
(A) codominance　(B) polygenic inheritance　(C) pleiotropy
(D) incomplete dominance　(E) blending inheritance

7. Which of the following features characterizes the lytic cycle of a viral infection?
(A) The viral DNA is inserted into a bacterial chromosome.
(B) The virus reproduces outside of the host cell.
(C) The cycle typically leads to the lysis of the host cell.
(D) The viral genes typically remain inactive once they are inside the host cell.
(E) The cycle typically ends when the host bacterium divides.

8. The cloning of Dolly the sheep _____.
(A) revealed that cloned mammals most resemble the egg donor
(B) demonstrated that the nuclei from differentiated mammalian cells can retain their full genetic potential
(C) demonstrated, for the first time, that eggs are haploid and body cells are diploid
(D) revealed that cloned mammals most resemble the sperm donor
(E) demonstrated that differentiated cells contain only a fraction of their full genetic potential

9. Genetic drift resulting from a disaster that drastically reduces population size is called _____.
(A) nonrandom mating　(B) the founder effect　(C) gene flow
(D) natural selection　(E) the bottleneck effect

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10. According to "evo-devo" thinking, an organism's body form can be substantially changed _____.
(A) through mutations that change sexually selected traits
(B) only through multiple mutations that produce a large number of new proteins
(C) through better nutrition
(D) through mutations or changes in the expression of one or a few "master control" genes that regulate development
(E) only when changes in the environment directly alter the major protein-coding genes in the organism's genome

11. The kind of vegetation in a tropical rain forest is generally determined by the amount of _____.
(A) light　(B) rainfall　(C) nitrogen in the soil
(D) minerals in the soil　(E) carbon dioxide in the air

12. The need for intense parental care of offspring favors mating systems that are _____.
(A) monogamous　(B) lifelong　(C) promiscuous　(D) polygamous　(E) temporary

13. Which of the following statements about insecticides is true?
(A) Simply killing many individuals is often the best way to reduce the size of a pest population.
(B) Limiting and lowering the quality of an existing habitat usually raises the carrying capacity of a population.
(C) Most insecticides kill the pest but not the pest's natural predators.
(D) Prey species often have a higher reproductive rate than do predators.
(E) To control agricultural pests, pest management uses biological controls, chemicals, or cultural methods, but never a combination of these.

14. In an average ecosystem, about how much energy is present in the organisms at a given trophic level compared to the organisms at the next higher trophic level?
(A) half as much　(B) twice as much　(C) ten times as much
(D) a tenth as much　(E) the amounts vary, depending on trophic level

15. Which of the following options correctly lists the sequence of structures through which water passes into a root?
(A) root hair, cortex, xylem, endodermis　(B) root hair, xylem, endodermis, phloem
(C) epidermis, endodermis, guard cell, xylem　(D) guard cell, endodermis, cortex, xylem
(E) epidermis, cortex, endodermis, xylem

16. An important effector function of antibody molecules is the _____.
(A) destruction of complement proteins　(B) agglutination of antigenic particles
(C) crystallization of antigenic particles　(D)solubilization of antigenic particles
(E) phagocytosis of antigenic particles

17. Which of the following statements best describes the molecular basis of muscle shortening?
(A) Rod-shaped protein polymers shorten by losing subunits from their ends.
(B) Rod-shaped, gel-like proteins contract by dehydrating.
(C) Individual filamentous proteins shorten by coiling.
(D) Protein filaments crawl along other protein filaments.
(E) Individual filamentous proteins contract.

18. The function of passageways for gas exchange in birds is to _____.
(A) store air for times of physical exertion　(B) adjust the temperature of air
(C) lighten the bird　(D) clean the air
(E) permit one-way ventilation of the lungs

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19. The main function of the AV node is to _____.
(A) set the rhythm of the heartbeat
(B) initiate the heartbeat
(C) relay a signal for the ventricles to contract
(D) relay the signal for the heart to contract from the right ventricle to the right atrium
(E) relay the signal for the heart to contract from the right heart to the left heart

20. Which of the following act mainly to regulate salt and water balance?
(A) mineralocorticoids (B) glucocorticoids (C) androgens (D) oxytocin (E) melatonin

※下列題目請標明題號，依序作答於試卷內「非選擇題作答區」。

二、名詞解釋（20 分）

1. feedback inhibition
2. counter current exchanger
3. antagonistic effect
4. transposon
5. restriction fragment length polymorphism (RFLP)

三、請說明維持神經訊號傳遞專一方向性的機制。（10 分）

四、請說明人類聽覺系統運作的機制，並解釋我們如何分辨聲音頻率的高低。（10 分）

五、請簡述避免多種受精的二個主要的機制。（10 分）

六、請就減數分裂的過程，探討 “aneuploidy” 突變發生的原因。（10 分）

試題隨卷繳回