請清楚標示題號並依序作答於試卷上

I. 選擇題: (40%)　※請作答於試卷內之「選擇題作答區」

(1-10 包含單選題和複選題; 11-20 為單選題)

1. The simplest classification, which is based on the type of cells, divides living organisms into two groups. What are these two groups?
   A) Eukaryote　B) Eubaceria　C) Prokaryote　D) Plantae　E) Animalia
2. Through which mechanism does ATP synthase obtain energy to synthesize ATP?
   A) glycolysis　C) fermentation　E) substrate level phosphorylation
   B) chemiosmosis　D) endocytosis
3. The cells of an ant and a horse are, on average, the same small size; a horse just has more of them. What is the main advantage of small cell size?
   A) Small cells are less likely to burst than large cells.
   B) A small cell has a less plasma membrane surface area than a large cell does.
   C) Small cells can better take up sufficient nutrients and oxygen to provide for their need.
   D) It takes less energy to make an organism out of small cells
   E) Small cells require less oxygen than large cells do
4. Which of the following structures is included in the bark of woody plants
   A) vascular cambium　B) cork cambium　C) primary xylem　D) secondary phloem　E) cork
5. Red-green color blindness is a sex-linked recessive trait (i.e., the responsible gene *is on the X chromosome*). From a marriage between a woman heterozygous for color-blindness gene and a normal vision man, which of the following predictions for their children is correct?
   A) all the boys are color blind　D) half of the girls have normal vision
   B) all the girls have normal vision　E) half of the girls are heterozygous carrier
   C) half of the boys are color blind
6. Whether an allele is dominant or recessive depends on
   A) how common the allele is, relative to other alleles
   B) whether it is inherited from the mother or the father
   C) which chromosome it is localized to
   D) whether it or another allele determines the phenotype when both are present
   E) whether or not it is a mutant
7. When *E. coli* cells are grown in a medium, which is lack of lactose and tryptophan, which of the followings will happen?
   A) the lac repressor is active　D) the trp operon is turned on
   B) the trp repressor is inactive　E) all genes in the cell are turned on
   C) the lac operon is turned on
8. A pea pod is developed from _____. A pea inside the pod is developed from _____.
   A) a sepal ... an ovary　C) an ovary ... an ovule　E) an endosperm ... an embryo
   B) a petal ... an overy　D) a stamen ... a carpel
9. Which of the following techniques can be used to monitor global gene expression of a genome?
   A) NMR　B) Southern blot　C) PCR　D) DNA microarray　E) Northern blot
10. Which of the following will not alter the allele frequencies in the population?
    A) nonrandom mating　B) natural selection　C) genetic drift　D) mutation　E) migration

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11. Blood pressure is lowest in _____.
A) veins B) arteries C) capillaries D) arterioles E) venules

12. When food distends the stomach, the hormone _____ is produced, which stimulates the gastric glands.
A) secretin B) gastrin C) cholecystokinin D) enterogastrone E) lipoprotein lipase

13. The output from the kidney for the marine bony fish would be:
A) a small volume of hypotonic urine.
B) a small volume of hypertonic urine.
C) a small volume of isotonic urine.
D) a large volume of hypotonic urine.
E) a large volume of hypertonic urine.

14. Which types of hormones can enter cells and turn specific genes on and off?
A) steroid and peptide hormones
B) steroid and thyroid hormones
C) thyroid and peptide hormones
D) peptide and phospholipid hormones
E) steroid and phospholipid hormones

15. One function of the developing follicle in ovary is to
A) stimulate ovulation.
B) secrete progesterone.
C) secrete estrogens.
D) secrete prolactin.
E) secrete glycoproteins

16. In a biology lab course, student A holds a vibrating tuning fork tightly against the back of student B's skull. This sends vibrations through the skull bones, setting the fluid in the cochlea in motion. Student B can hear the tuning fork this way, but not when it is held away from her skull a few centimeters from her ear. Where is student B's hearing problem located?
A) in the auditory nerve leading to the brain
B) in the hair cells of the cochlea
C) in the bones of the middle ear
D) in the fluid of the cochlea
E) in the basilar membrane of the cochlea

17. Which of these is a community?
A) all of the *Escherichia coli* (a species of bacteria) living in your colon
B) all of the organisms living in your house
C) all of the students in your class
D) all of the people living in your town
E) all of the sunflowers in your backyard

18. If a population's growth rate decreases as the population size approaches carrying capacity, the population's growth follows a(n) _____ model.
A) exponential B) hypergeometric C) mathematical D) logistic E) geometric

19. The single greatest threat to biodiversity comes from _____.
A) invasive species
B) pollution
C) overexploitation
D) human predation
E) habitat destruction and fragmentation

20. In general, you would expect an energy pyramid to have roughly the same shape as a diagram illustrating changes in _____ with increasing trophic level.
A) the sizes of organisms
B) the brain mass of organisms
C) biomass
D) primary productivity
E) the life spans of organisms

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II.簡答題(60%)

1. What is the most fundamental characteristics of living organisms?
2. What is double fertilization?
3. *A* and *B* are two linked genes. *A* allele is dominant to *a*, and *B* allele is dominant to *b*. If the numbers and phenotypes of the progeny from a cross between *Ab*/*aB* and *ab*/*ab* are:

trait A	trait B	number
dominant	dominant	N1
dominant	recessive	N2
recessive	dominant	N3
recessive	recessive	N4

How would you calculate the recombination frequency between the *A* and *B* loci?

4. What is telomerase?
5. A nondisjunction of the sex chromosomes occurred at meiosis I during a spermatogenesis, and the meiosis II was normal. One of the sperm resulted from this particular spermatogenesis fertilized with a normal egg and developed into a boy. What is the sex chromosome composition of this boy?
6. In the United States, fresh fruits in markets are stored in plastic bags with holes. What is the main purpose of the holes?
7. Why does it take at least two exposures to an allergen to trigger an allergic reaction?
8. What effects can introduced species have on biological communities?
9. In what basic way do insects carry out gas exchange differently from the way fishes and humans do?
10. The cheetahs were once widespread in Africa and Asia. The number of cheetahs fell drastically during the 1800s. The cheetahs suffered a severe bottleneck, when farmers hunted the animals to near extinction. Today, only a small populations of cheetahs exist in the wild. Would you expect modern cheetahs to have more genetic variation or less genetic variation than cheetahs did 1,000 years ago? Why? How about their capacity to adapt to environmental changes?
11. In what fundamental way does the body plan of a cnidarian differ from that of all other animals?
12. How does the structure of a synapse ensure that signals pass only in one direction, from a sending neuron to a receiving cell?

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