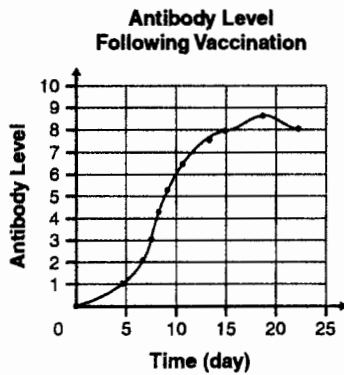


※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

**Part 1: Single-Choice Questions (90%; 3 per question)**

1. The graph below shows the production of antibodies following a flu shot. Which of the following statements *best* describes the maximum antibody level of a person's body after a flu vaccination?



- A It occurs immediately.
- B It is never achieved.
- C It is achieved on day 15.
- D It is achieved on day 18.

2. The jackrabbit population sometimes decreases dramatically. One possible explanation for this decrease is that the coyote population has increased. This explanation is a scientific

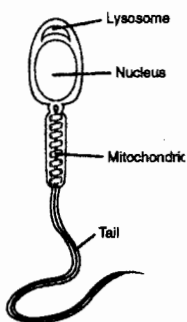
- A conclusion.
- B experiment.
- C hypothesis.
- D law.

3. Students hypothesized that their normal pulse rates would double after doing 50 sit-ups. After completing three trials, four students averaged their individual pulse rates and recorded their results below. Based on the data, a conclusion cannot be made because

Student	Average Pulse Rate After 3 Trials
1	120 beats/min.
2	98 beats/min.
3	135 beats/min.
4	110 beats/min.

- A the exercise was not strenuous enough to affect the pulse rates.
- B control data of normal pulse rates for each individual are missing.
- C the variability in pulse rates among the students is too great.
- D not enough trials were conducted to be able to draw a conclusion.

4. The diagram below shows a male gamete



Which structure stores *most* of the genetic information?

- A mitochondrion
- B lysosome
- C nucleus
- D tail

5. Which of the following organelles releases energy from sugars?
- A ribosomes
  - B vacuoles
  - C chloroplasts
  - D mitochondria
6. Which of the following organelles use carbon dioxide to produce sugars?
- A vacuoles
  - B ribosomes
  - C chloroplasts
  - D mitochondria
7. Which of the following produces identical nuclei in cells?
- A pollination
  - B mitosis
  - C osmosis
  - D fertilization
8. Which of the following is the fundamental element found in all living organisms?
- A iron
  - B carbon
  - C calcium
  - D magnesium
9. Which of the following structures is *not* found in bacteria?
- A ribosome
  - B cytoplasm
  - C cell membrane
  - D nuclear membrane
10. Which of the following lacks a nucleus?
- A a plant cell
  - B an animal cell
  - C an amoeba
  - D a virus

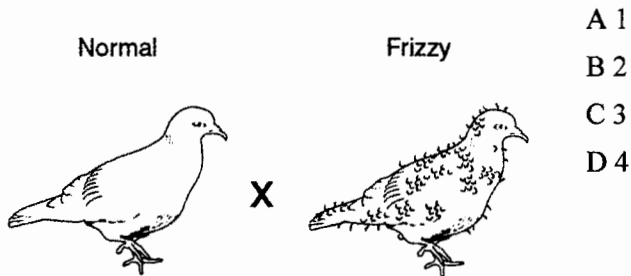
11. The inheritance of a trait in humans is *best* described as being determined by

- A a single allele.
- B one or more pairs of alleles.
- C one pair of chromosomes.
- D the sex chromosomes of the offspring.

12. What process is necessary for the inherited traits of an organism to be passed along by sexual reproduction?

- A mitosis
- B meiosis
- C mutation
- D fission

13. In pigeons, the allele for normal feathers (F) is dominant to the allele for frizzy feathers (f). If a purebred, normal-feathered bird (FF) is crossed with a frizzy-feathered bird (ff), how many different feather phenotypes are possible in the offspring?



14. Which of the following *best* describes how DNA and RNA are similar?

- A They both contain the nitrogen bases thymine and adenine.
- B They both are formed in a double-helix structure.
- C They both are composed of five different nucleotides.
- D They both contain the nitrogen bases cytosine and guanine.

15. Which of the following sets of organisms would be found in a wetland ecosystem?

- A tortoise, lizard, fly
- B salamander, mosquito, frog
- C moose, seal, lemming
- D lion, giraffe, beetle

16. Which of the following processes allows the cells of an organism to use carbon from the environment?

- A mitosis
- B fertilization
- C transpiration

D photosynthesis

17. Fungi are an important part of a terrestrial ecosystem because they

A store energy.

B bond oxygen to sulfur.

C function as producers.

D recycle organic matter.

18. A particular allele in mice is lethal in homozygotes. Heterozygotes, however, develop normally. Why does this allele remain in the population?

A Homozygous mice pass the allele to their offspring.

B The recessive allele is masked in heterozygotes.

C Natural selection selects for the homozygous individual with normal alleles.

D Natural selection selects against the heterozygous individual.

19. Which of the following is a source of genetic variation within a species?

A cloning

B mutation

C selective breeding

D natural selection

20. The diet of white-tailed deer consists primarily of shrubs. Sika are another species of deer that eat both grasses and shrubs. After an extended drought period, why might the sika population be favored over the white-tailed deer population?

A Sika require less food than do the white-tailed deer.

B Sika require more water than do the white-tailed deer.

C Sika have more food sources than do the white-tailed deer.

D Sika have fewer food sources than do the white-tailed deer.

21. Rainfall in a tropical region is below average for 10 consecutive years. Insect species adapted for dry conditions are much more plentiful at the end of the 10 years. Which of the following statements *best* explains the increase in the population of these insects?

A Biodiversity in the region has increased due to the dry conditions.

B Insects with a high tolerance for dry conditions have migrated out of the region.

C Natural selection has favored insect species with a high tolerance for dry conditions.

D Natural selection has selected against insect species that are adapted for dry conditions

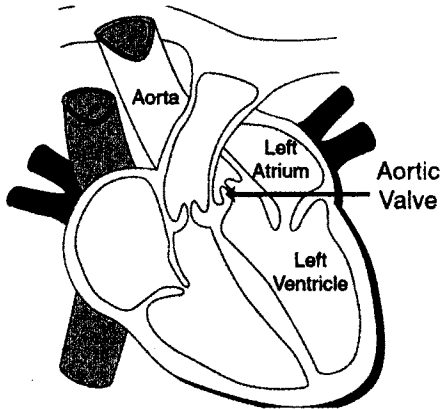
22. Skeletal structures are common between two animals of different species. These structures probably exist because both species

- A have a common food source.
- B live in the same environment.
- C have survived until the present time.
- D are related to a common ancestor.

23. Which three human-body systems coordinate to cause an arm to move?

- A nervous, muscular, skeletal
- B respiratory, muscular, digestive
- C skeletal, circulatory, immune
- D digestive, nervous, circulatory

24. The diagram below shows a human heart. When contracted, the left ventricle pumps oxygenated blood to the body. What is the purpose of the aortic valve that separates the left ventricle from the aorta?



- A to prevent blood from flowing back into the left ventricle
- B to prevent blood from flowing into the aorta
- C to push blood into the left ventricle
- D to push blood into the aorta

25. As a person exercises, carbon dioxide ( $\text{CO}_2$ ) levels in the blood increase. This causes the nervous system to signal which of these systems to respond?

- A digestive and immune
- B immune and respiratory
- C respiratory and circulatory
- D circulatory and endocrine

26. Which of the following does *not* correctly describe kidney function? The kidneys

- A. Contribute significantly to long-term regulation of arterial blood pressure by maintaining the proper plasma volume
- B. Produce urine of a fixed composition in order to maintain homeostasis of extracellular fluid
- C. Assist in maintaining proper acid-base balance in the body
- D. Secrete hormones

27. Greengard P, Kandel ER and Carlsson A are Nobel laureates in Physiology or Medicine in the year of 2000.

Please find the best description for their work.

- A. For the discoveries concerning signal transduction in the nervous system
- B. For their discovery of RNA interference-gene silencing by double-strand RNA
- C. For their discovery of the cellular origin of retroviral oncogenes
- D. For their discoveries of growth factors
28. Which one is *best description* for the criteria that define a neurotransmitter?
- A. The substance must be present with the presynaptic neuron
- B. Specific receptors for the substance must be present on the postsynaptic cell
- C. The substance must be released in respond to presynaptic depolarization and the release is  $\text{Ca}^{2+}$ -dependent
- D. A, B and C are all correct.
29. Fecal microbiota transplantation (FMT) also known as a stool transplant is the process of transplantation of fecal bacterial from a healthy individual into a recipient. Because of an effective treatment for patients suffering from \_\_\_\_\_ infection in the early of 2000, FMT has gained in increasing prominence. Which one of microbiota should be filled into the blank?
- A. Streptococcus pyogens
- B. Pseudomonas aeruginosa
- C. Clostridium difficile
- D. Staphylococcus aureus
30. Test your knowledge about Ebola virus disease. Please find the best combination to fill into the sentence as below. Ebola is introduced into the human population through \_\_\_\_\_. Samples from patients are an extreme \_\_\_\_\_; laboratory testing on non-inactivated samples should be conducted under maximum biological containment conditions. Current treatment options are supportive care-rehydration with oral or intravenous fluids- and treatment of specific symptoms, improves survival. There is \_\_\_\_\_ treatment available for this disease.
- A. Close contact; biohazard; licensed vaccine
- B. Close contact; biohazard; as yet no licensed vaccine
- C. Aerosol transmission; biohazard; licensed vaccine
- D. Aerosol transmission; biohazard; as yet no licensed vaccine

**Part II Essay questions (10%)**

What is Ethics in Research & Why is it Important?