

國 立 清 華 大 學 命 題 紙

九十二學年度 生命科學院研究所 甲組 碩士班研究生招生考試

科目 生物學 科號 0802 共 5 頁第 1 頁 *請在試卷【答案卷】內作答

I. 選擇題 60% (單選，每題兩分，答案請填在答案欄之中，如果無答案請寫 0)

1. The structural feature that allows DNA to replicate itself is the (此大題請於電腦卡上作答)

- a. complementary pairing of the bases. b. sugar-phosphate backbone. c. phosphodiester bonding of the helices. d. twisting of the molecule to form an alpha helix. e. three-part structure of the nucleotides.

2. Which two functional groups are always found in amino acids?

- a. amine and sulfhydryl b. ketone and amine c. alcohol and aldehyde d. carbonyl and carboxyl e. carboxyl and amine

3. Which of the following is not a protein?

- a. hemoglobin b. androgen c. kinase d. antibody e. insulin

4. When an enzyme catalyzes a reaction,

- a. it lowers the activation energy of the reaction b. it becomes a product c. it raises the activation energy of the reaction d. it acts as a reactant e. both b and d

5. Which of the following substances would have the most trouble crossing a biological membrane by diffusion through the lipid bilayer?

- a. water b. O_2 c. carbon dioxide d. sodium ion e. a small, nonpolar molecule such as butane

6. Eukaryotic and prokaryotic cells are different in many ways. Which of the following is a significant difference between the genomes of prokaryotes and eukaryotes?

- a. Prokaryotic cells are diploid. b. Eukaryotic cells are haploid. c. Prokaryotic chromosomes are sometimes called "genochromosomes". d. Prokaryotic cells have chromosomes packaged with a relatively large amount of protein. e. Instead of a nucleus, prokaryotic cells have a "nucleoid" region.

7. Which of the following organelles does not belong to the endomembrane system?

- a. rough endoplasmic reticulum b. smooth endoplasmic reticulum c. nuclear envelope d. Golgi apparatus e. mitochondrion

8. Human sex hormones belong to what family of lipids?

- a. phospholipids b. waxes c. steroids d. triglycerides e. fatty acids

9. Anything that prevent ATP formation will

- a. force the cell to rely on lipids for energy b. result in the conversion of kinetic energy to potential energy
c. result in cell death d. force the cell to rely on ADP for energy e. have no effect on the cell

10. Sister chromatids are

- a. found only when a cell is not actively dividing b. formed when chromatids separate during cell division
c. made only of DNA d. tightly linked together at the centromere e. unique to prokaryotes

11. Eukaryotic cells spend most of their cell cycle in which phase?

- a. interphase b. prophase c. metaphase d. anaphase e. telophase

12. A particular species of worm has a diploid number of 8. How many chromosomal combinations are possible for gametes formed by meiosis?

- a. 24 b. 8 c. 32 d. 16 e. 12

13. The nucleotide sequence of a DNA codon is CTT. A messenger RNA molecule with a complementary codon is transcribed from the DNA. In the process of protein synthesis, a transfer RNA pairs with the mRNA codon. What is the nucleotide sequence of the tRNA anticodon?

- a. GAA b. CTT c. CUU d. GUU e. GTT

14. Why does a DNA strand grow only in the 5' to 3' direction?

- a. because DNA polymerase can only add nucleotides to the 3' end of the growing molecule
b. because DNA polymerase can only add nucleotides to the 5' end of the growing molecule
c. because mRNA can only read a DNA molecule in the 5' to 3' direction
d. because tRNA can only transfer a DNA molecule in the 5' to 3' direction
e. only a and c are true

15. Which of the following correctly ranks the structures in order of size, from largest to smallest?

- a. chromosome–nucleotide–gene–codon b. gene–chromosome–codon–nucleotide c. chromosome–gene–codon–nucleotide
d. chromosome–nucleotide–codon–gene e. chromosome–codon–nucleotide–gene

16. A plant of genotype *AaBbCC* is crossed with an *AaBbCc* plant. What is the probability of an offspring having the genotype *AABBCC*?

- a. 1/8 b. 1/16 c. 3/16 d. 3/32 e. 1/32

17. How many genes are there in a human egg cell?

- a. 23 b. 500–1000 c. 5000–10000 d. 30000–40000 e. 300000–400000

18. The $^{14}\text{C}:$ ^{12}C ratio in a fossil can often be used to tell approximately how long ago the animal died. Why?
- The ratio of a fossil drops progressively as the radioactive isotope ^{14}C changes into ^{12}C .
 - The ratio of a fossil rises progressively as the radioactive isotope ^{12}C changes into ^{14}C .
 - The ratio of a fossil drops progressively because ground water dissolves ^{14}C faster than ^{12}C .
 - The ratio of a fossil drops progressively as the radioactive isotope ^{14}C decays into other chemical elements.
 - The ratio of a fossil rises progressively because ground water dissolves ^{14}C faster than ^{12}C .
19. Animals probably evolved from
- plants
 - protists
 - fungi
 - lichens
 - bacteria
20. Which of the following statements regarding cDNA is NOT true?
- A cDNA gene is made using reverse transcriptase.
 - A cDNA gene is often longer than the natural form of the gene.
 - The full name of cDNA is complementary DNA.
 - It represents the gene active transcribed in the starting cells.
 - All above are correct.
21. The light reactions of photosynthesis produce
- glucose, ADP, NADP^+
 - glucose, ADP, NADP^+ , CO_2
 - ATP, NADP^+
 - ATP, NADPH, O_2
 - ATP, NADPH, CO_2
22. The bacteria that cause tetanus can be killed on by prolonged heating at temperatures considerably above boiling. This suggests that tetanus bacteria
- have cell walls containing cholesterol
 - protect themselves by secreting antibiotics
 - secrete endotoxins
 - are autotrophic
 - produce endospores
23. All of the following statements about hormones are correct EXCEPT:
- They are produced by endocrine glands.
 - They travel to different areas of the body.
 - They are used to communicate between different organisms.
 - They are carried by the circulatory system.
 - They elicit specific biological responses from target cells
24. Cell-mediated immunity is mostly the function of
- T cells.
 - B cells.
 - erythrocytes.
 - macrophages.
 - cytotoxic cells.
25. Which of the following is CORRECT for a blood pressure of 130/80?
- The systolic pressure is 130.
 - The diastolic pressure is 80.
 - The blood pressure during heart contraction is 80.
- I only
 - III only
 - I and II only
 - II and III only
 - I, II, and III.

26. Given the steps show below, which of the following is the CORRECT sequence for transmission at a chemical synapse?

- A. neurotransmitter binds with receptor
- B. sodium ions rush into neuron's cytoplasm
- C. action potential depolarizes the presynaptic membrane
- D. ion channel opens to allow particular ion to enter cell
- E. synaptic vesicles release neurotransmitter into the synaptic cleft

a. A,B,C,D,E b. B,C,E,D,A c. C,B,E,A,D d. D,C,A,B,E e. E,A,B,D,C

27. A protein consists of subunit A and subunit B. Subunit A contains 180 amino acids, while subunit B contains 220 amino acids.

- a. The protein contains 400 peptide bonds.
- b. The protein is encoded by a gene with 800 nucleotides.
- c. The protein can be cleaved by kinase.
- d. The protein contains 398 peptide bonds.
- e. The protein is encoded by two genes (A and B); gene A contains 360 nucleotides, while gene B contains 440 nucleotides.

28. The organ that plays a major role in osmoregulation in humans is the

- a. gill b. spleen c. thymus d. gallbladder e. kidney

29. Which of the following was the most recent developmental process that directly affected this embryo?

- a. fertilization b. gastrulation c. blastula formation d. morula formation e. cleavage

30. When antibodies attack antigens, clumping of the affected cells generally occurs. This is best explained by

- a. at least two antigen binding sites per antibody.
- b. disulfide bridges between the antigens.
- c. complement that makes the affected cells sticky.
- d. bonds between class I and class II MHC molecules
- e. denaturation of the antibodies.

II. 問答題 40% (每題十分)

1. Diagram and describe the life cycle of a bacteriophage.
2. Draw an RNA nucleotide. How does RNA differ from DNA?
3. Explain the endosymbiotic hypothesis for the origin of chloroplasts and mitochondria.
4. Define and give an example of biological magnification. What qualities are present in materials that undergo biological magnification? In what trophical level are the problems worst, and why?