

95 學年度 生醫工程與環境科學 系(所) 甲 分子生物學、
丙 醫學暨保健物理 組碩士班入學考試

科目 普通生物學 科目代碼 3005、
3204 共 5 頁第 1 頁 *請在試卷【答案卷】內作答

I. Questions (50%)

1. 請說明為什麼 DNA 帶有的遺傳訊息為鹼基 A、T、G 和 C，而 RNA 將 T 改為 U 為 A、U、G 和 C？(試由 DNA mutation 時 repair 的機制和效率來解釋之，並分別考量如果 DNA 和 RNA 遺傳訊息同時為 ATGC 或 AUGC 時，對 DNA 複製時會造成的影響為何)。(15%)
2. 針對重組 DNA (recombination DNA)，要確認生成之菌落有無插入標的(target) DNA 的方法之一是利用乳糖操作組(lac operon)原理，外加人工合成之誘導子(inducer) — IPTG (isopropyl thiogalactoside)，若使 X-gal 呈色產生藍色，代表沒有插入 target DNA，試解釋為什麼可以利用此方式來鑑定重組 DNA 是否成功?(15%)
3. 目前尚未證實禽流感(Avian Flu)會人畜傳染，為什麼需要對禽流感進行防疫工作?(10%)
4. 解釋為何某些人並沒有比其他人產生或攝食較多的膽固醇，可是血液中卻有過多的膽固醇?(10%)

II. Multiple choice (Only one best answer for each question) (50%; 2 points/each)

1. Which adaptations below might you expect to see in cells that have large energy (ATP) requirements?
(A) elevated numbers of mitochondria with more highly folded mitochondrial inner membranes
(B) elevated numbers of Golgi apparatus with more cisternae
(C) elevated numbers of chloroplasts with more thylakoids
(D) elevated numbers of centrioles with more tubules
(E) elevated numbers of nuclei with more nucleoli
2. Which of the following is required for the synthesis of DNA during replication?
(A) DNA polymerase (B) dNTPs (C) magnesium ions (D) template DNA
(E) all of the above
3. You have physical characteristics (traits) that appear in neither of your parents. This supports the notion that
(A) Traits can only be passed from grandparents to grandchildren
(B) Traits are not inheritable
(C) Traits can persist in populations for many generation
(D) Traits express themselves only when favorable conditions exist
(E) Traits are inherited in every generation of offspring

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4. The difference between self-fertilization and cross-fertilization is:
- (A) Self-fertilization involves pollen and eggs from the same plant while cross-fertilization involves pollen and eggs from two different plants.
 - (B) Self-fertilization involves pollen from one variety to fertilize eggs from another variety while cross-fertilization involves pollen and eggs from the same varieties
 - (C) Self-fertilization requires the assistance of a pollinator (wind, insects, scientists) while cross-fertilization does not need a pollinator
 - (D) Self-fertilization creates hybrid offspring while cross-pollination creates dihybrid offspring
 - (E) None of the above is accurate
5. When DNA is cut with a restriction enzyme, the resulting fragments have
- (A) a 3' hydroxyl (B) a 5' hydroxyl (C) a 5' phosphate (D) both A and C (E) both B and C
6. The phenotype of an organism
- (A) cannot be seen with the naked eye
 - (B) occurs only in males
 - (C) represents an individual's genetic composition
 - (D) reflects traits that are expressed, seen, or otherwise detected
 - (E) represents the relationship between genes and alleles
7. Ultraviolet radiation creates _____ in DNA.
- (A) point mutations (B) mutational hot spots (C) 5-methyl cytosine residues
 - (D) breakages (E) thymine dimers
8. Which of the following is NOT a tenet of the Cell Theory?
- (A) Cells are the fundamental units of life.
 - (B) All organisms are composed of one or more cells.
 - (C) Cells arise from preexisting cells.
 - (D) Cells live forever.
 - (E) Cells contain hereditary information that passes from one generation to the next
9. Sex determination in *Drosophila* is regulated by which cellular mechanism?
- (A) addition of a 5' cap (B) differential splicing (C) post-translational processing
 - (D) choice of alternative poly(A) sites (E) all of the above
10. To what part of an mRNA is the anticodon of a tRNA complementary?
- (A) the beginning (B) the end (C) the codon (D) the anticodon (E) the stop codon

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11. Many disorders are characterized by abnormalities in the structure of individual chromosomes. The work of the Human Genome Project has allowed us to
- (A) see banding sequence of the stained chromosomes under a microscope to identify abnormal chromosome structure
 - (B) correlate chromosomal abnormalities with the nucleotide sequences found at those damaged chromosomal positions
 - (C) artificially create chromosomal abnormalities
 - (D) form a DNA donor pool to contribute to those with chromosomal abnormalities
 - (E) legislate who gets normal chromosomes and who gets abnormal chromosomes
12. While studying a cell with the electron microscope, a scientist notes the following: numerous ribosomes, a well-developed endoplasmic reticulum, chloroplasts, nucleus, and a cell wall. Which of the following could be the source of this cell?
- (A) animal
 - (B) bacterium
 - (C) plant
 - (D) prokaryotic algae
 - (E) fungus
13. ALL of the following are involved in cell division EXCEPT:
- (A) disappearance of nuclear envelope
 - (B) reappearance of nuclear envelope
 - (C) chromosome condensation
 - (D) changes in the cytoskeleton
 - (E) disappearance of the cell membrane
14. The division of cytoplasm in eukaryotic cells is:
- (A) cytokinesis
 - (B) cytolysis
 - (C) cytoplasmic streaming
 - (D) cytofusion
 - (E) cytocryro
15. In the 1960's the flow of cell functioning information in prokaryotic cells was identified as
- (A) transcription of DNA genetic information → translation of mRNA message → formation of proteins necessary for cell function
 - (B) replication of DNA genetic information → cell division → cell division → functioning cell
 - (C) translation of mRNA message in nucleus to DNA genetic information which directs functioning of cell
 - (D) formation of proteins necessary for cell function → assembly of DNA genetic code
 - (E) transfer of DNA genetic information to alternate cells via plasmids which direct function of cell
16. What region of the brain helps to read hormone levels in the blood and regulate feedback mechanisms with the master gland?
- (A) hypothalamus
 - (B) adrenals
 - (C) pituitary
 - (D) parathyroid
 - (E) thymus

17. Which enzyme is correctly matched with its function?
- (A) restriction enzyme: severs DNA at specific nucleotide sequences called restriction sites
 - (B) restriction endonuclease: glues the two strands of DNA back together after replication
 - (C) DNA ligase: cuts plasmid DNA in bacterial cells into one gene units
 - (D) Palindromase: matches the nucleotide sequences of one strand of DNA to another
 - (E) DNAase: repairs the hydrogen bonds that holds base pairs together in a DNA strand
18. Computers designed to scan large amount of DNA sequence easily identify open reading frames by locating
- (A) a repeating string of nucleotide bases
 - (B) the AUG start codon and UGA stop codon
 - (C) two equally spaced regions of DNA coding for the same amino acid order
 - (D) a comparable DNA sequence published on the internet
 - (E) sections of DNA that match the code for a specific gene
19. Which of the following is NOT a long or short-term goal of the Human Genome project?
- (A) decipher the full set of genetic instructions in human DNA
 - (B) develop the set of human genetic instructions as a research tool for scientists
 - (C) provide a genetic map of the 24 different human chromosomes (22 autosomes and X & Y)
 - (D) understand all of the genes, what they do, how they interact
 - (E) reproduce the genetic instruction in a fruit fly or other model organism in humans
20. A mixture of DNA fragments has been separated using agarose gel electrophoresis. The number of bands resulting indicates
- (A) how many nucleotides were present in the mixture
 - (B) how strong the electric current was that used to run the electrophoresis
 - (C) how many different varieties of nucleic acids were present in the mixture
 - (D) how many different-sized fragments of DNA were in the mixture
 - (E) how many times the agarose gel unit was turned on and turned off
21. Humans dominate ecosystems throughout the Earth. Our increasing numbers and dependence on fossil fuels affect ecosystems in all of the following ways EXCEPT:
- (A) destruction of the ozone layer
 - (B) water pollution
 - (C) habitat damage
 - (D) air enrichment
 - (E) greenhouse effect
22. Select the INCORRECT statement about motor neurons.
- (A) Motor neurons carry information to voluntary muscles such as the bicep
 - (B) Motor neurons carry information to involuntary effectors such as the heart
 - (C) Motor neurons are a part of the peripheral nervous system
 - (D) Motor neurons are a part of the central nervous system
 - (E) Motor neurons are characterized as somatic and automatic

23. All of the following can be used to describe a cloning vector EXCEPT
- (A) a cloning vector is a genetic hitchhiker
 - (B) a cloning vector is a genetically engineered plasmid
 - (C) virus can act as a cloning vector
 - (D) a cloning vector is an artificial lipid that can be used to control cell replication
 - (E) a cloning vector is a vehicle that inserts a fragment of foreign DNA into the genome of a host cell
24. What determines whether a cell can be a target cell for a particular hormone?
- (A) If it makes the hormone
 - (B) If it has a receptor for the hormone.
 - (C) If it degrades the hormone
 - (D) If it alters the hormone.
 - (E) If it denatures the hormone.
25. Your stress begins. Your blood pressure rises, receptors sense the increase and your brain sends a message causing your heart rate to decrease and arterioles to dilate. Your blood pressure drops and returns to normal. This is an example of what physiological process?
- (A) crisis intervention cycle leading to hysteria
 - (B) positive feedback loop leading to instability
 - (C) negative feedback loop leading to stability
 - (D) synergy sequence leading to whole system integration
 - (E) none of the above

~End~