國立成功大學 108 學年度碩士班招生考試試題

系　　所：生命科學系

考試科目：分子生物學

考試日期：0224，節次：3

※ 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。

選擇題　每題 2 分

1. All of the following statements about DNA are true EXCEPT:
   (a) DNA is less stable than RNA.
   (b) The most common DNA helix conformation is the B-form.
   (c) The DNA strands in a double helix are anti-parallel.
   (d) G-C pairs are stronger than A-T pairs.
   (e) Structurally, DNA is a sugar-phosphate backbone with nitrogenous bases attached to the sugars.
2. All of the following statements about DNA coiling are true EXCEPT:
   (a) Supercoiling is necessary to fit DNA into cells.
   (b) Gyrase and topoisomerase are two enzymes involved in supercoiling.
   (c) Both bacterial and eukaryotic cells contain histones.
   (d) Nucleosomes consist of a DNA-histone complex.
   (e) Eukaryotic DNA contains much more complex supercoiling than bacterial DNA.
3. All of the following statements about gel electrophoresis are true EXCEPT:
   (a) Agarose separates DNA molecules based on charge.
   (b) Ethidium bromide is used to visualize DNA.
   (c) Polyacrylamide gels are used for DNA sequencing.
   (d) DNA migrates toward the positive electrode because it is negatively charged.
   (e) Molecular weight standards are used to determine the size of DNA molecules.
4. Which of the following statements best describe the “GC ratio”?
   (a) Determines how much heat is required to melt complementary DNA strands.
   (b) Indicates the relative amount of G and C bases as a percent of all bases present.
   (c) Indicates the relative amount of G bases as a percent of all G and C bases present.
   (d) a + b
   (e) a + c
5. Which of the following nucleic acid hybridization techniques is described incorrectly?
   (a) Northern blot: A DNA probe binds to an RNA target.
   (b) Zoo blot: A method commonly used to determine coding and non-coding DNA sequences.
   (c) Southern blot: An RNA probe binds to an RNA target.
   (d) FISH: A DNA probe binds to an intracellular DNA or RNA target.
   (e) None of the above.

6. Cloning is the insertion of a DNA fragment into the proper cloning vector—often times a plasmid. Usually, the fragment is cloned into the _____, and the presence of the fragment is detected due to _____ of another gene.
   (a) Construct; recombination
   (b) Multiple cloning site; insertional inactivation
   (c) Construct; complementation
   (d) Polylinker; hybridization
   (e) None of the above
7. Why is the synthesis of cDNA necessary to study eukaryotic DNA?
   (a) cDNA is more easily recognized by bacteria than other forms of DNA.
   (b) cDNA is always in a high copy number, making gene expression easier.
   (c) cDNA has the introns removed.
   (d) cDNA is single-stranded.
   (e) None of the above.
8. In an analysis of the nucleotide composition of double-stranded DNA to see which bases are equivalent in concentration, which of the following would be true?
   (a) A = C
   (b) A = G and C = T
   (c) A + C = G + T
   (d) A + T = G + C
   (e) A = G and C = T *and* A + C = G + T are both true.
9. Which statement best describe the technology of the PCR?
   (a) Incorporates dideoxynucleotides to help produce DNA fragments of the proper length.
   (b) Utilizes either an upstream or downstream primer, but not both simultaneously.
   (c) Requires a large amount of template DNA to be successful.
   (d) Utilizes the DNA polymerase of a thermophilic bacterium.
   (e) Can only be used to amplify DNA if the sequence is precisely known.
10. You would most likely expect that the virus you discovered in the tunnels underneath the Tainan subway system was a single-stranded RNA virus if it had which of the following base composition?
   (a) 20% A, 20% T, 0% U, 30% G, 30% C
   (b) 20% A, 0% T, 30% U, 20% G, 30% C
   (c) 20% A, 30% T, 0% U, 20% G, 30% C
   (d) 20% A, 0% T, 20% U, 30% G, 30% C

(e) 20% A, 20% T, 20% U, 20% G, 20% C

11. Antisense oligonucleotides can be used in the laboratory to:
    (a) Prevent normal mRNA splicing.
    (b) Block ribosome binding sites.
    (c) Target mRNA for degradation.
    (d) All of the above.
    (e) None of the above.
12. The association of separate amino acid chains to constitute one active protein is called the
    (a) Primary structure
    (b) Secondary structure
    (c) Tertiary structure
    (d) Quaternary structure
    (e) Quinternary structure

問答題

14. What component of the nucleotide is responsible for the absorption of ultraviolet light? How is this technique important in the analysis of nucleic acids? (8分)
15. Please describe homologous recombination system in *E. coli*. (8 分)
16. What is alternative splicing, and why is it important? (8 分)
17. Describe advantage of using Cre recombinase for genetic engineering in eukaryotic cells. (8 分)
18. What purpose do capping and poly-A tail addition serve for eukaryotic mRNAs? (8 分)
19. Please describe and give examples of frameshift mutations in the genetic code. (12 分)
20. What are the two important events that must occur even before translation initiation can take place? (12 分)
21. Please describe the dynamical systems theoretical framework provides an integrated view of the origin and early evolution of life. (12 分)