國立嘉義大學九十六學年度
生化科技學系碩士班招生考試試題

科目：分子生物學

1. 人類基因體大約由多少鹼基對 (base pairs) 所組成？ 在某一段雙股 DNA 中，其 G+C 比 A+T 之含量多 12%，請問這段 DNA 含有 T 的百分比為何？ (20 points)

2. Multiple choice (1 point each)

(1) Which of the following has the least to do with RT-PCR?

A. Restriction enzyme
B. mRNA
C. cDNA
D. Reverse Transcriptase
E. DNA polymerase

(2) The *lac-Z* gene, which is found in many plasmid cloning vectors, encodes which of the following proteins?

A. DNA polymerase
B. DNA ligase
C. Beta-lactamase
D. Beta-galactosidase
E. Reverse transcriptase

(3) The large (Klenow) fragment of *E. coli* DNA polymerase I contains which of the following activities?

A. reverse transcriptase activity
B. polymerase activity and 3'-5'-exonuclease activity
C. nick-translation activity
D. polymerase activity and nick-translation activity
E. 5'-3'-exonuclease activity

(4) Which of the following would be eliminated by “hot start” PCR?

A. Aerosol contamination from the barrel of pipetors.
B. Addition of a non-templated nucleotide to the terminal end of PCR products.
C. Infidelity of DNA copying by Taq DNA polymerase.
D. Formation of primer-dimers.
E. Difficulty in amplifying DNA over 3 kb in length.

(5) Which of the following is meant by the term "insertional inactivation"?

A. When an inserted DNA disrupts an existing reporter gene.
B. It is part of Western Blotting.
C. It is a method of “hot start” PCR.
D. It is when M13 helper phage causes a pseudophage to be made.
E. When an antibody interferes with enzyme activity.

(6) Which of the following would not be possible to address using a Northern blot?

A. Location of restriction sites in a particular gene.
B. Spatial (*ie*. tissue-specific) expression of a particular gene.
C. Temporal (ie. developmental) expression of a particular gene.
D. mRNA size.
E. Number of splice-variant types of RNA.

(7) Which of the following transformation procedures is the method of choice for transferring DNA into plant cells?

A. Ca-phosphate precipitation
B. transfer by gene gun
C. electroporation
D. CaCl treatment and heat shock
E. lipofection

(8) Which of the following is NOT usually found in plasmid cloning vectors?

A. antibiotic-resistance gene
B. centromere
C. origin of replication
D. reporter gene such as l*acZ*
E. multiple cloning site

背面尚有試題

(9) Why don't restriction enzymes cleave bacterial DNA in the species which make the enzymes?

A. The bacterial DNA does not carry the sequences recognized by the restriction enzyme.

B. Bacterial DNA repair mechanisms can repair the DNA faster than it can be cut by enzymes.

C. The restriction enzymes are not synthesized until long after foreign DNA enters the cell.

D. The bacterial DNA is modified at the restriction sites.

E. The restriction enzymes are synthesized in a different cellular compartment than that which contains the genomic DNA.

(10) Electrophoresis is utilized to separate DNA based on differences in:

A. shape

B. length

C. charge

D. nucleotide sequence

E. charge and nucleotide sequence

3. Short Questions (2 points each)

(1) If you set up a regular PCR reaction on a single (double-stranded) DNA fragment and ran it for six cycles, how many (double-stranded) DNAs would there be?

(2) If you did the same reaction above only with one primer rather than the usual two, how many (single-stranded) DNA strands would there be in the tube?

(3) What is the template used by telomerase to add telomeric repeats at the ends of chromosomes?

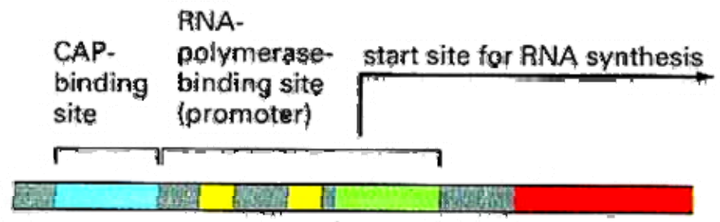
(4) Which combinations of histones form "histone-fold" dimers with each other in the nucleosome?

(5) Describe the assembly of the spliceosome.

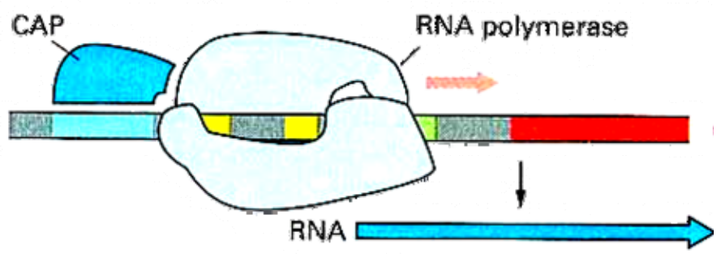
4. (a) (6 points) Although dUTP generated in the cell is also the substrate for DNA polymerase and a high frequency for the conversion of cytosine to uracil (via the process spontaneous deamination), DNA does not contain uracil. Why? (b) (i) (2 points) Define the “expression vector” (ii) (4 points) To be a good prokaryotic expression vector, what are the minimum elements should be provided on the vector? (iii) (4 points) Please define “recombinant proteins” and “authentic proteins”. And describe the major difference in the protein structure of these proteins. (iv) (4 points) Give two reasons to rational why many proteins are expressed as fusion proteins instead of native proteins.

5. Dual control of the *lac* operon is shown below, please indicate the existences of the glucose and lactose for the four states (A~D), and explain the reason caused the operon on or off. (20 points)

A.

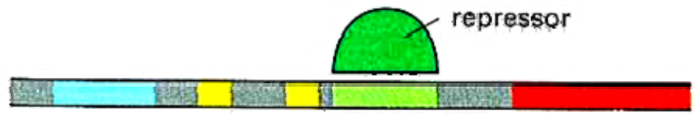


B.



C.

D.



6. What are the effects of acetylatiion, methylation and phosphorylation of histones? How might these modifications change a nucleosome? Please name two enzymes that are required for assembly of nucleosomes. (20 points)