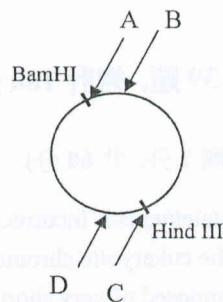
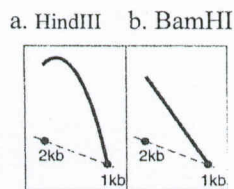


分子生物學試題 (全部 39 題, 總計 100 分)

一、 選擇題: (30 題, 每題 2 分, 共 60 分)

- Which of the following statements is incorrect?  
(A) Genes make up most of the eukaryotic chromosomal DNA  
(B) Microsatellite DNA is composed of very short, tandemly repeated sequences.  
(C) The majority of human intergenic sequences are composed of repetitive DNA  
(D) *E. coli* has higher gene density than human
- Which of the following amino acid is hydrophobic?  
(A) Lysine (B) Cysteine (C) Leucine (D) Tyrosine
- DNA polymerase I is responsible for DNA \_\_\_\_\_ in *E. coli*.  
(A) Repair (B) Replication (C) Splicing (D) Degradation
- Which of the followings is not used in a Polymerase Chain Reaction (PCR)?  
(A) DNA template (B) RNA polymerase (C) Primers (D) Free nucleotides
- Which of the following molecules is not encoded in human genome?  
(A) DNA ligase (B) RNA polymerase (C) Reverse transcriptase (D) Topoisomerase
- Which of the following description is correct?  
(A) Histone proteins are mainly negatively charged.  
(B) Nucleosomes appear uniformly throughout genomic DNA  
(C) Nucleosomes contain histones  
(D) Chromosomes contain centrosomes
- Which subunit of *E. coli* DNA polymerase III load  $\beta$  clamp onto DNA?  
(A)  $\alpha$  (B)  $\epsilon$  (C)  $\omega$  (D)  $\gamma$
- Pyrimidine dimer cannot be repaired by:  
(A) Photoreactivation (B) Nucleotide excision repair  
(C) Mismatch repair (D) Translesion DNA synthesis.
- Which of the following is a DNA helicase?  
(A) DnaA (B) DnaB (C) DnaG (D) Gyrase

10.



This figure shows the results of cleaving a 2- $\mu$ m plasmid with HindIII (a) and BamHI and run the products on two-dimensional gel. Can you tell where does this plasmid start replicating?

(A), (B), (C), or (D).

11. During Eukaryotic DNA replication, prereplicative complex (pre-RC) is activated by:

- (A) DnaA      (B) Cdc6      (C) Cdk      (D) DNA polymerase

12. Which DNA repair mechanism is more likely to generate mutations?

- (A) Base excision repair      (B) Nucleotide excision repair  
(C) Homologous recombination      (D) Non-homologous end-joining

13. Which of the following is not repetitive sequence?

- (A) SINE      (B) *Alu*      (C) STS      (D) LINE.

14. Which of following technique is to detect mRNA level in the cells?

- (A) Northern blotting      (B) Southern blotting      (C) Western blotting      (D) Eastern blotting

15. What kind of primer does the Viral-like retrotransposon use in the reverse transcription process?

- (A) short single-stranded DNA      (B) Nicked DNA strand      (C) tRNA      (D) rRNA

16. Which technique is used to determine the 3D structure of a protein?

- (A) X-ray diffraction      (B) 2D Electrophoresis  
(C) Mass spectrometry      (D) Size exclusion chromatography

17. What is the function of the Rho factor?

- (A) Initiation of DNA replication      (B) Termination of DNA replication  
(C) Initiation of RNA transcription      (D) Termination of RNA transcription

18. Which instrument is best to determine the localization of a red fluorescence protein?  
(A) Laser scanning confocal microscope (B) Transmission electron microscope  
(C) Dark-field microscope (D) Atomic force microscope
19. Which is influenced by the strength of the Kozak consensus sequence?  
(A) The rate of DNA replication (B) The expression level of mRNA  
(C) Recognition of alternative splice sites (D) The amount of protein output from a mRNA
20. Which RNA polymerase is responsible for expression of ribosomal RNA in eukaryotes?  
(A) RNA polymerase I (B) RNA polymerase II  
(C) RNA polymerase III (D) RNA polymerase IV
21. Which is the most likely consequence to the regulation of the *lac* operon if the -30 sequence of the *lac* promoter is replaced by a consensus sequence?  
(A) The expression of the *lac* operon is fully activated in the absence of lactose  
(B) The *lac* operon can not be activated by lactose  
(C) cAMP is not required for full activation of the *lac* operon  
(D) All the regulatory mechanisms are not affected
22. Which protein is a component of the RNA-induced silencing complex (RISC)?  
(A) Drosha (B) Exportin 5 (C) Dicer (D) Argonaute
23. Which subunit of the eukaryotic RNA polymerase II recognizes the TATA box?  
(A) TFII B (B) TFII F (C) TFII H (D) TFII D
24. Which polymerase contains RNA in its structure?  
(A) DNA polymerase (B) RNA polymerase  
(C) Reverse transcriptase (D) Telomerase
25. Which post-transcriptional modification occurs to the C-terminal domain of elongating eukaryotic RNA polymerase II?  
(A) Phosphorylation (B) Acetylation (C) Ubiquitination (D) Methylation



26. Which subunit is released from the bacterial RNA polymerase holoenzyme during promoter clearance?

- (A) The  $\alpha$  subunit                      (B) The  $\beta$  subunit  
(C) The  $\beta'$  subunit                      (D) The  $\sigma$  subunit

27. If an internal ribosome binding site is present on a mRNA in the eukaryotic cells, how many polypeptide is produced from that mRNA ?

- (A) One                                      (B) Two  
(C) Three                                    (D) Four

28. Which molecule's level is detected by the attenuation mechanism of the tryptophan operon?

- (A) UTP  
(B) The tryptophan repressor  
(C) Tryptophan  
(D) Tryptophan charged tRNA

29. Which RNA is specifically present in the germline cells?

- (A) MicroRNA (miRNA)                      (B) Small interference RNA (siRNA)  
(C) Piwi-interacting RNA (piRNA)                      (D) Long non-coding RNAs (lncRNA)

30. Which is a ribozyme?

- (A) DNA polymerase                      (B) RNA polymerase  
(C) Capping enzyme                      (D) Ribosome

二. 簡答題：(每題 2 分)

Please describe the functions of the following molecules: (2 points each)

31. Spo11  
32. RAG1 and RAG2  
33. Ku70 and Ku80  
34. DNA ligase

三. 問答題：(五題, 共 32 分)

35. Please describe the homologous recombination process in *E. coli*. (4 points)
36. Describe the complete process (including **initiation, elongation, and termination**) of DNA replication in *E. coli*. (8 points)
37. Describe the process and the participating protein complex of pre-mRNA splicing? (8 points)
38. Describe the two molecular mechanisms governing the fidelity of the translation process? (6 points)
39. Briefly describe how riboswitch regulates gene expression. (6 points)