112學年度分子生物所分子生物學試題（全部44題，總計100分）

一、 選擇題：（30題，每題2分，共計60分）

1. Prokaryotes contain a _____chromosome, and eukaryotes contain _____ chromosomes.
   (A) single-stranded circular; single-stranded linear
   (B) single-stranded linear; single-stranded circular
   (C) double-stranded circular; double-stranded linear
   (D) double-stranded linear; double-stranded circular

2. Which statement is correct?
   (A) Histone proteins are mainly positively charged.
   (B) The core histones include H1, H2A, H2B, H3, and H4.
   (C) Histone proteins interact mostly with the bases of the DNA.
   (D) None of the above.

3. Which of the following protein is not required for DNA replication in E. coli?
   (A) DNA helicase　(B) Primase　(C) DNA ligase　(D) DNA glycosylase.

4. Which of the following is a true statement regarding DNA polymerase?
   (A) It is a processive enzyme
   (B) It contains proofreading activity
   (C) It requires a short primer or oligonucleotide to start synthesizing new DNA strands
   (D) All of the above

5. Which activity of DNA polymerase I is also called "proofreading" activity?
   (A) 5' to 3' polymerase activity　(B) 3' to 5' polymerase activity
   (C) 5' to 3' exonuclease activity　(D) 3' to 5' exonuclease activ

6. Which subunit of DNA polymerase III increases its processivity?
   (A) α subunit　(B) γ complex
   (C) ε subunit　(D) β subunit

7. During DNA Replication, a short segment of RNA must form before DNA synthesis can begin. This is done by which enzyme?
   (A) Helicase & gyrase　(B) RNAse H　(C) Ligase　(D) Primase

8. Amino acids are the building blocks of:
   (A) DNA and RNA　(B) lipids　(C) proteins　(D) carbohydrates

9. Which description is false?
   (A) X-rays are hazardous because they cause DNA double-strand breaks, which are hard to repair.
   (B) an A to G mutation is called a point mutation.
   (C) Human cells are used in the Ames test to determine the carcinogenic effects of chemical.
   (D) Non-homologous end joining usually results in DNA mutations.

10. Which of the following molecules is involved in DNA nucleotide excision repair?
   (A) RecBCD (B) MutH (C) UvrC (D) Spo11

11. Which of the following molecules is involved in DNA mismatch repair?
   (A) RecBCD (B) MutH (C) UvrC (D) Spo11

12. Which of the following molecules is involved in non-homologous end-joining?
   (A) RecBCD (B) Ku70 (C) MutS (D) Glycosylase

13. If a species contains 32% adenine (A) in its DNA, what percentage of guanine (G) would it also contain?
   (A) 32% (B) 64% (C) 36% (D) 18%

14. Which of the following is not in the pre-replicative complexes (pre-RCs)?
   (A) ORC (B) Rad51 (C) Cdc6 (D) Mcm 2-7

15. The unique enzyme that retrotransposons encode and does not exist in human cells is
   (A) DNA polymerase (B) Topoisomerase (C) Reverse Transcriptase (D) DNA ligase.

16. Which of the following subunit does not belong to the core enzyme of prokaryotic RNA polymerase?
   (A) α (B) β (C) β' (D) σ

17. 5S rRNA is transcribed by:
   (A) Reverse transcriptase (B) RNA polymerase III
   (C) RNA polymerase II (D) RNA polymerase I

18. Following the previous question, miRNA(micro RNA) is transcribed by?
   (A) RNA polymerase I (B) RNA polymerase II
   (C) RNA polymerase III (D) RNA dependent RNA polymerase

19. Which structure is classified as the transactivation domain of an activator?
   (A) Glutamine-rich (B) basic Helix loop helix (C) Homeobox (D) Zinc finger

20. The complex that first binds to the promoter in transcription initiation step is:
(A) TFIIA (B) TFIIB (C) TFIID (D) TFIIF

21. For Kozak sequence, which positions and the corresponding bases are important for the translation efficiency if the underline of AUG is consider as the +1?
(A) –4 (C/U) and +4 (U) (B) -3 (G/A) and +4 (G)
(C) -10 (UAUA) and -25 (G) (D) -10 (UAUA) and -35 (U)

22. The shape of final product in the trans-splicing is?
(A) lariat (B) linear (C) circular (D) Y-shape

23. During the maturation tRNA, the enzyme that is responsible for the 5' end processing is:
(A) RNase III (B) RNase II (C) RNase P (D) RNase E

24. In precursor mRNA splicing, U6 snRNA can pair with two snRNAs and the intron site. These two snRNAs and intron site are:
(A) U1 and U2, 5' splicing site (B) U1 and U4, 3' splicing site
(C) U2 and U4, 5' splicing site (D) U2 and U5, 3' splicing site

25. In the infection of *E. coli* by λ phage, which description for the binding ability of cro is correct?
(A) $O_L1 < O_L2 < O_L3$ (B) $O_R1 > O_R2 > O_R3$
(C) $O_R1 < O_R2 = O_R3$ (D) $O_L1 < O_L2 = O_L3$

26. The ribosome-binding site (RBS) in mRNA is named as?
(A) TATA box sequence (B) Kozak sequence
(C) Okazaki sequence (D) Shine-Dalgarno sequence

27. The scissor in the RISC complex for cutting mRNA is:
(A) Argonaute (B) Drosha (C) DGCR8/ Pasha (D) Dicer

28. The kinase to phosphorylate the CTD domain of RNA polymerase in the transcriptional initiation step:
(A) pTEFb (B) TAF1 (C) TFIIE (D) TFIIH

29. Which enzyme is involved in RNA editing?
(A) terminal uridylyl transferase (TUTase) (B) guanylyl transferase
(C) RNA triphosphatase (D) methyltransferase

30. Which method is NOT used for detecting protein-protein interaction :

(A) Far western blot　(B) Western blot

(C) Yeast two hybrid assay　(D) Co-immunoprecipitation assay

二、 簡答題：(10題, 每題2分，共計20分)

31. What enzyme removes excessive supercoiling ahead of the replication fork?

32. Name three classes of transposons.

33. What are the three different activities that DNA polymerase I pocesses?

34. Name two molecules that are involved in V(D)J recombination.

35. In *E. coli*, what molecule loads the β subunit of DNA polymerase III onto DNA?

36. The small RNAs that are required for precursor rRNA processing.

37. The working model for transcriptional termination in eukaryote.

38. Three components of eIF4 in translation of eukaryote.

39. Two proteins that participates in the polyadenylation.

40. The reason to explain the number of tRNA is less than 64 but is more than 20 in a certain species?

三、 問答題: (4題，每題5分，共計20分)

41. Please illustrate and describe the initiation process of DNA replication in E. coli.

42. Please describe the molecular process (including all the molecules involved) of homologous recombination in *E. coli.*

43. Please describe the regulation for tryptophan attenuation in prokaryote.

44. Please explain the positive and negative regulation of lac operon.