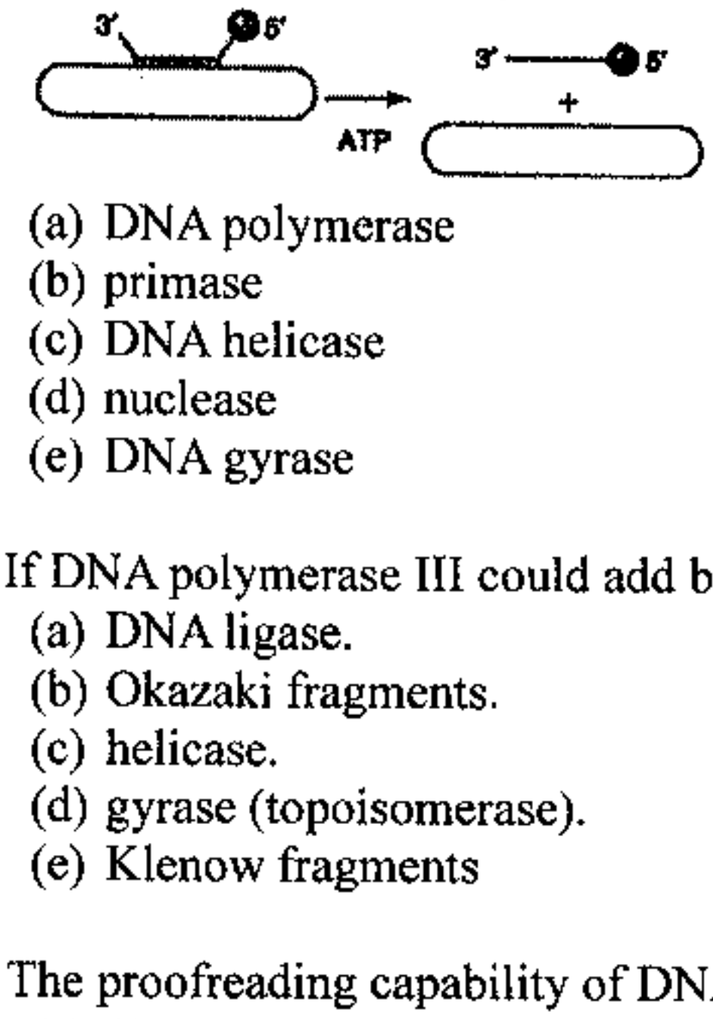
I. Multiple choice (choose the best answer, 2 pt each) 此大題請於電腦卡上作答

1. Which enzyme can catalyze the following reaction



(a) DNA polymerase
(b) primase
(c) DNA helicase
(d) nuclease
(e) DNA gyrase

2. If DNA polymerase III could add bases in the 3' to 5' direction in *E. coli*, there would be no need for
(a) DNA ligase.
(b) Okazaki fragments.
(c) helicase.
(d) gyrase (topoisomerase).
(e) Klenow fragments

3. The proofreading capability of DNA polymerase is equivalent to
(a) 3'→5' exonuclease activity.
(b) 5'→3' exonuclease activity.
(c) 3'→5' endonuclease activity.
(d) 5'→3' endonuclease activity.
(e) None of these choices

4. Ultraviolet light typically produces a(n)
(a) alkylation
(b) insertion
(c) tautomeric shift
(d) T-T dimmer
(e) Depurination

5. Which of the following statement concerning the *Ac-Ds* of maize is NOT TRUE
(a) Ds element cannot transpose by itself
(b) Ac element cannot transpose by itself
(c) these DNA elements can induce chromosome breakage
(d) these DNA elements can induce the formation of dicentric chromosome
(e) Ds element cannot induce chromosome breakage by itself

6. Which one of the following process requires a RecA activity
(a) activating immunoglobulin gene rearrangement
(b) resolving a Holliday junction during recombination
(c) resolving cointegrate form during transposition
(d) activating SOS gene expression
(e) Integration of λ

7. Why DNA polymerase I, in stead of Klenow fragment, is used for the nick-translation reaction?
   (a) because the DNA polymerase I possesses the DNA polymerization activity
   (b) because the DNA polymerase I can synthesize DNA without the need of primer
   (c) because the DNA polymerase I possesses 5' to 3' exonuclease activity
   (d) because the DNA polymerase I possesses 3' to 5 exonuclease activity
   (e) all of above

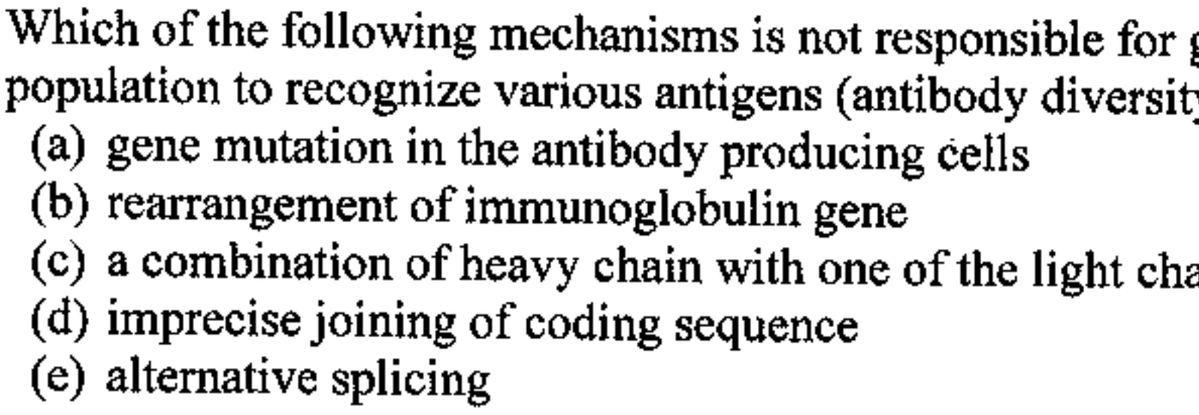
8. Which of the following enzymatic activities is involved in replicating the ends of eucaryotic chromosomes?
   (a) DNA-dependent DNA polymerase
   (b) RNA-dependent RNA polymerase
   (c) RNA-dependent DNA polymerase
   (d) Klenow enzyme
   (e) DNA-dependent RNA polymerase III

9. The existence of Okazaki fragments demonstrate the
   (a) DNA synthesis is semiconservative
   (b) DNA synthesis is discontinuous
   (c) DNA synthesis is conservative
   (d) DNA synthesis is dispersed
   (e) DNA synthesis requires a primer

10. Which of the following mechanisms is not responsible for generating a diversified antibody population to recognize various antigens (antibody diversity)?
   (a) gene mutation in the antibody producing cells
   (b) rearrangement of immunoglobulin gene
   (c) a combination of heavy chain with one of the light chains
   (d) imprecise joining of coding sequence
   (e) alternative splicing

11. Which of the following enzyme uses RNA to replicate DNA?
   (a) DNA polymerase
   (b) RNA polymerase
   (c) Reverse transcriptase
   (d) Restriction enzyme

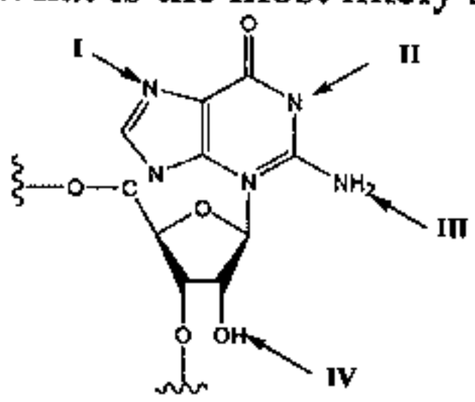
12. Hydrogen bonding is strongest between which two of the following structures?



I　II　III　IV

   (a) I and II
   (b) I and IV
   (c) II and III
   (d) II and IV

13. What is the most likely site of attack of alkylating agents on the DNA structure?



(a) I
(b) II
(c) III
(d) VI

14. How many aminoacyl-tRNA synthetases are there in a human cell?
(a) 64
(b) 61
(c) 23
(d) 20

15. The enzyme that is used to join two DNA fragments is:
(a) a restriction enzyme.
(b) DNA polymerase.
(c) an endonuclease.
(d) DNA gyrase.
(e) DNA ligase.

16. Which of the following proteins bind GTP?
IF-2 II. IF-3 III. EF-Tu IV. EF-G
(a) I, III
(b) I, III, IV
(c) I, II, III
(d) I, II, IV

17. Peptidyl transferase activity can be destroyed upon treatment with
(a) SDS
(b) Phenol
(c) Proteinase K
(d) RNase T1

18. Which of the following is not a cloning vector?
(a) cosmid
(b) plasmid
(c) autonomously replicating sequence (ARS)
(d) yeast Artificial Chromosome (YAC)
(e) bacterial Artificial Chromosome (BAC)

19. When mutations are available in a gene of interest, the wild-type allele of the gene can be identified by a process called:
(a) a. *in situ* hybridization.
(b) plaque hybridization.
(c) Southern hybridization.
(d) complementation screening.
(e) *in vitro* packaging.

20. Which of the following cloning vectors would you use to clone an insert of size 500 kb?
(a) a plasmid vector
(b) shttle vector
(c) cosmid vector
(d) phage λ
(e) yeast artificial chromosome

II. **Matching**

For questions 1-20 chose the most appropriate answer from the answer box below. Certain answer may be used more than once or none at all. (2 pt each)

ACUAAC	AAUAAA	GUAUAG	GGUGUU	GGGCCCC
U2 snRNA	U4 snRNA	U5 snRNA	U6 snRNA	gRNA
polymerase III	hnRNA	tRNA	RNAi	rRNA
SL 1	polymerase I	polymerase II	TFIIA	TFIIB
TFIID	TFIIH	TFIIH	CBF	α subunit
β subunit	σ factor			

1. _____ stimulates initiation but not elongation of transcription.
2. The RNA polymerase_____ has a C-terminal domain that can recognize and bind to a promoter's UP element.
3. The RNA polymerase___ binds nucleotides at the active site where phosphodiester bonds are formed
4. The RNA polymerase that makes 28S rRNA is _____.
5. The RNA polymerase that makes hnRNA is _____.
6. The RNA polymerase that makes 5S rRNA is _____.
7. The transcription factor that binds to TATA is _____.
8. The transcription factor that binds to RNA polymerase II directly is _____.
9. The transcription factor that contains most TAF_{II}s is _____
10. The transcription factor that has a DNA helicase activity is _____.
11. The transcription factor that does not bind by itself to the promoter but can interact with the crude RNA polymerase I is _____.
12. The transcription factor that can stimulate activity of RNA polymerase I is _____.
13. The consensus sequence at the branch point of an intron is _____.
14. The consensus sequence for polyadenylation signal is _____.
15. The consensus sequence at the 5' splicing site is _____.
16. The _____ interacts with the 3' splicing site.
17. The _____ interacts with sequence around branch point during splicing.
18. The small nuclear RNA _____ does not have protein associated with it.
19. Control of gene expression by specific mRNA degradation is called _____.
20. The RNA that participates in RNA editing is _____.

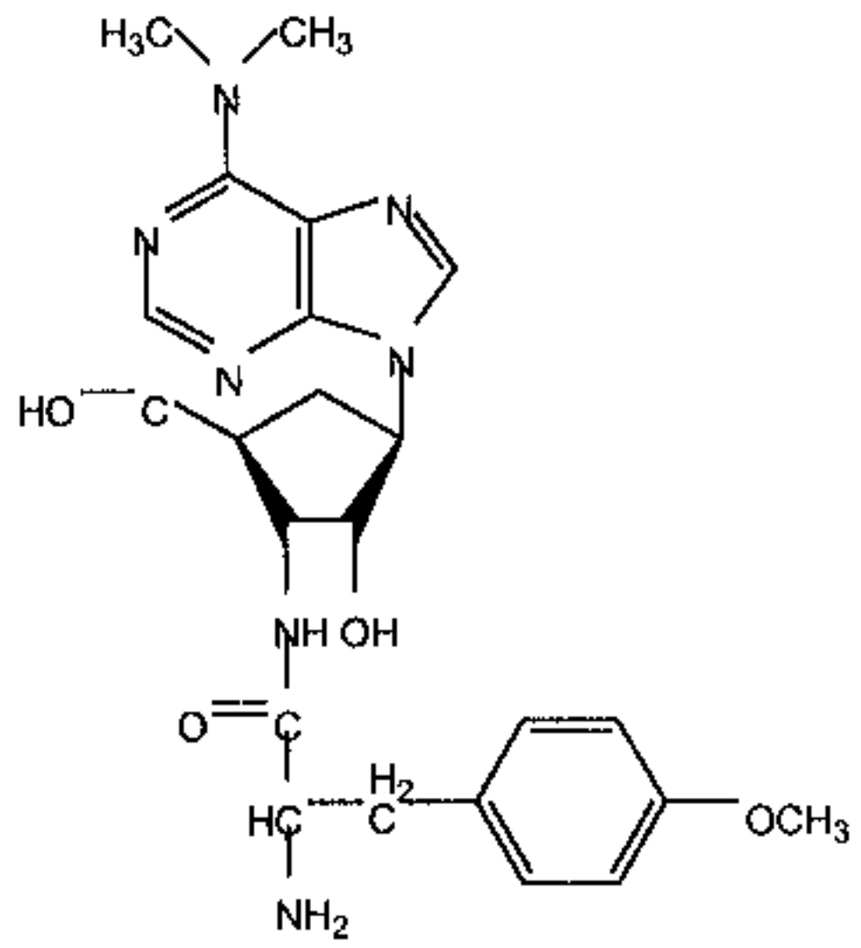
III. **Short anser/essay**

1. Determine the length and the nature (5' or 3') of the overhang (if any) created by the following enzymes. (3 pt)

*Cla*I	AT↓CGAT
*Pvu*II	CAG↓CTG
*Sac*I	GAGCT↓C

2. How would you label the 5'ends of a double-strained DNA? The 3'-end? (4 pt)

3. Answer the following questions based on your knowledge about the chemical structure of an antibiotic puromycin as shown below.



(A) What molecule does puromycin mimic? (2 pt)
(B) How can puromycin be used to study whether charged-tRNA is in the A or P site of the ribosome.? (2 pt)
(C) Design two experiments to investigate specific protein synthesis events employing puromycin? (4 pt)

4. Attenuation in the *trp* operon imposes an extra level of control on an operon. Please explain how can RNA polymerase reads through the attenuator under low tryptophan condition. (5 pt)