弘光科技大學
100學年度生物科技系碩士班考試入學筆試試題及答案卷
考試科目：生物技術概論

准考證號碼：□□□□□□

注意：
1.請核對考試科目是否相符。
2.請核對試卷上之准考證號與准考證及座位上之准考證號碼是否相符。
3.本試題共兩部分，I. 選擇題 35 題，每題 2分，計 70分；II.問答題 2 大題，計 30 分；共計 100 分。
4.請將答案依題號順序填寫於規定之範圍內。

I. MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question. (70%)

1. Which of the following electrophoretic analytic procedures does not depend on the charge of the protein?
   (A) Free zone capillary electrophoresis
   (B) Gel electrophoresis
   (C) SDS polyacrylamide gel electrophoresis (SDS-PAGE)
   (D) Isoelectric focusing
2. All of the following forces may play a role in the formation of quarternary structure of protein **EXCEPT**:
   (A) Hydrogen bonds
   (B) Peptide bonds
   (C) Disulfide bridges
   (D) Hydrophobic interactions
3. The specific activity of an enzyme is _____.
   (A) the activity of an enzyme in relation to a standard preparation of the enzyme
   (B) the number of enzyme units per milligram of enzyme protein
   (C) the activity of an enzyme in the presence of its preferred substrate
   (D) the amount of enzyme causing transformation of 1 μmol of substrate per minute under standard conditions
4. Which of the following sequences is most likely to be a restriction enzyme recognition site?
   (A) CGGC
   (B) GTCGAC
   (C) CGC
   (D) GTAATC
5. The first drug produced using recombinant DNA technology was _____.
   (A) streptokinase
   (B) tPA
   (C) insulin
   (D) penicillin
6. NADPH is a coenzyme for which of the following enzymatic reactions?
   (A) Aminotransferase
   (B) Oxidation-reduction
   (C) Phosphate group transfer
   (D) Fixation of carbon dioxide
7. Which of the following compounds is a gratuitous inducer of β-galactosidase in *E. coli*?
   (A) Glucose
   (B) Isopropylthiogalactoside (IPTG)
   (C) Fructose
   (D) Pentose
8. Thermal denaturation of DNA results in _____.
   (A) a hypochromic effect
   (B) a melting temperature that depends on the base content
   (C) cleavage of the glycosidic bonds
   (D) cleavage of the phosphodiester bonds
9. Biologists make recombinant DNA by linking together different kinds of DNA with the enzyme _____.
   (A) topoisomerase
   (B) DNA gyrase
   (C) DNA helicase
   (D) DNA ligase
10. Which of the following is **NOT** a vector used in gene therapy?
    (A) AAV (adeno-associated virus)
    (B) HSV (herpes-simplex virus)
    (C) Retrovirus
    (D) HIV (human immunodeficiency virus)
11. In PCR, the purpose for the heating cycle is to _____.
    (A) kill the bacteria
    (B) make the DNA glow
    (C) separate the DNA strands
    (D) move the DNA in the gel

12. _____ is the commercial use of living organisms or their components to improve animal and human health, agriculture, and the environment.
(A) Biotechnology
(B) DNA fingerprinting
(C) Bioconversion
(D) Bioremediation

13. _____ is the enzyme that copies RNA into DNA.
(A) DNA polymerase
(B) RNA polymerase
(C) Reverse transcriptase
(D) DNA ligase

14. The natural role of restriction endonucleases in bacteria is to _____.
(A) degrade foreign DNA
(B) “glue” damaged DNA back together
(C) cut DNA to be joined with other DNA fragments
(D) limit the amount of DNA replication that can occur

15. Which of the following is **NOT** used as a reporter gene?
(A) GFP (Green Fluorescent Protein)
(B) TMV (Tobacco mosaic virus)
(C) GUS (beta-glucuronidase)
(D) LUC (Luciferase)

16. _____ are used to select genes of interest from a genomic library.
(A) Restriction enzymes
(B) Cloning vectors
(C) DNA probes
(D) Gene targets

17. _____ is a restriction enzyme isolated from *Stapylococcus aureus*.
(A) *Bam*HI
(B) *Sau*3AI
(C) *Sma*I
(D) *Eco*RI

18. Which of the following can **NOT** be used for molecular weight determination for proteins?
(A) SDS-PAGE
(B) Gel filtration
(C) Northern blotting
(D) Mass spectrometry

19. Which of the following experiments is used for DNA-RNA hybridization?
(A) Northern blot
(B) Southern blot
(C) Western blot
(D) Eastern blot

20. What is the complementary strand (5’-end to 3’-end) of DNA, 5’-AGCGCATA-3’?
(A) 5’-AGCGCATA-3’
(B) 5’-TCGCGTAT-3’
(C) 5’-ATACGCGA-3’
(D) 5’-TATGCGCT-3’

21. _____ is an RNA molecule possessing a well defined tertiary structure that enables it to catalyze a chemical reaction.
(A) rRNA
(B) mRNA
(C) Ribozyme
(D) SiRNA

22. _____ is a regulatory region of DNA located upstream of a gene, providing a control point for regulated gene transcription
(A) Terminator
(B) Promoter
(C) Replication origin
(D) Open reading frame

23. _____ is complementary to the mRNA so that they cannot be translated into protein.
(A) tRNA
(B) cDNA
(C) Sense RNA
(D) Antisense RNA

24. Blue-white screening in cloning experiments is used _____.
(A) to express the product of a cloned gene
(B) to test for the presence of a plasmid in a bacteria
(C) to test for the presence of a cloned insert in a plasmid
(D) to reveal the identify of a cloned DNA fragment

25. Who gave the Deoxyribonucleic Acid (DNA) model?
(A) Einstein
(B) Watson and Crick
(C) Newton
(D) Michael

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26. Put the following in to the correct sequence for the flow of the Central Dogma: 1. Translation, 2. mRNA, 3. Protein, 4. Gene, 5. Transcription.
(A) 4,1,2,5,3
(B) 3,1,2,5,4
(C) 4,5,2,1,3
(D) 2,5,1,4,3

27. A(n) ____ is a multisubunit protein produced by B cells that binds to foreign substances and alters components of the immune system.
(A) antibody
(B) cytokine
(C) antigen
(D) none of the above

28. A point mutation that changes a codon specifying an amino acid into a stop codon is called a _____.
(A) missense mutation
(B) nonsense mutation
(C) frameshift mutation
(D) deletion mutation

29. How many nucleotides are needed to code for a protein with 450 amino acids?
(A) at least 150
(B) at least 450
(C) at least 900
(D) at least 1,350

30. In an SDS-PAGE experiment proteins are separated on the basis of their _____.
(A) negatively charged side-chains
(B) positively charged side-chains
(C) molecular weight
(D) different isoelectric points

31. Which of the technologies listed below is a valuable method for mass-producing drugs and other useful proteins?
(A) Recombinant DNA technology
(B) Transgenic technology
(C) Gene targeting
(D) Knockout technology

32. Ni-NTA is a metal chelate affinity chromatography for purification of proteins with _____.
(A) His6-tags
(B) Flag-tags
(C) HA-tags
(D) GST-tags

33. Put the following in to the correct sequence for the flow of the recombinant DNA technique: 1. antibiotic screening; 2. DNA ligation ; 3. PCR amplification; 4. Transformation; 5. Restrication enzyme digestion.
(A) 5,2,3,4,1
(B) 3,5,4,2,1
(C) 5,3,4,2,1
(D) 3,5,2,4,1

34. Which pair of amino acids absorbs the most UV light at 280 nm?
(A) Thr and His
(B) Trp and Tyr
(C) Phe and Pro
(D) Ala and Gly

35. Ion exchange chromatography separates proteins by _____.
(A) charge
(B) size
(C) protein affinity
(D) hydrophobic interaction

II. Questions. (30%)

1. Polymerase chain reaction (PCR) (10%)
   (1) Please describe the principle and the steps of the PCR.
   (2) Please describe all of the reaction materials in PCR.
   (3) Please design the PCR primers (primer length: 16 mer) for amplify the whole DNA fragment described below.

   5’- atgaaaaaat ggattcgcaa cgggacggtt gtgacggcgt cagacacgta tcaggcagac gtgctgatcg acggcgaaaa agtcgtcgcg atcggctcgg - 3’

2. Recombinant DNA technology and protein purification. (20%)
   (1) What is plasmid?
   (2) Describe the application of plasmid in biotechnology.
   (3) Please describe the function of the elements in this **Plasmid (Fig. 1)**:
   (Fill in the table in **ANSWERING SHEET**; Example: ATG → the translation start codon; Stop Condons → translation termination.)

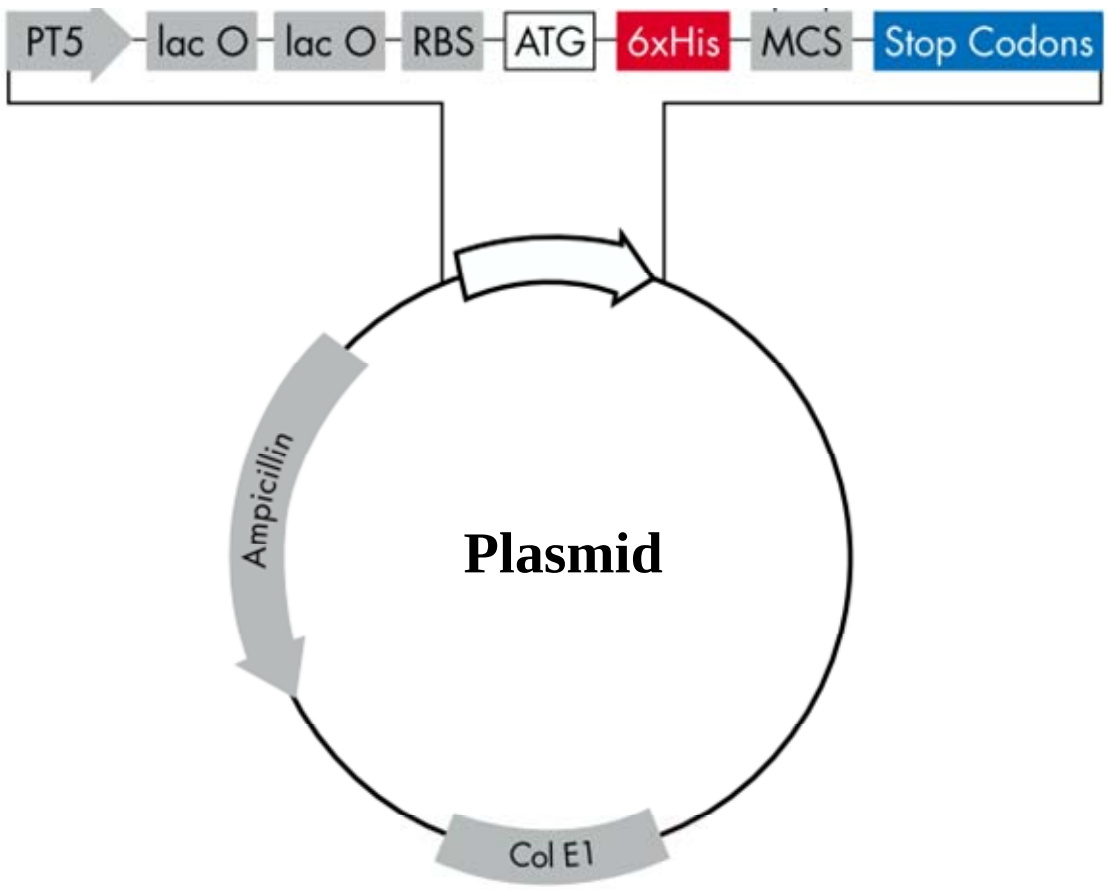

Fig. 1. Genetic map of the **Plasmid**.

   (4) Please describe the transcriptional regulation of the cloned gene in this **Plasmid (Fig. 1)**?
   (5) Please design a purification procedure for the gene expressed product in this **Plasmid (Fig. 1)**. Describe the procedure in detail.

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ANSWERING SHEET

answers: only in the appropriate boxes of the answer sheets, nothing else will be marked.

I. MULTIPLE CHOICE, 70 points (2 points for each)

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35					

II. Questions, 30 points

1.

(1)

(2)

(3)

Forward primer: 5’-_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ -3’

Backward primer: 5’-_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ -3’

2.

(1)

(2)

(3)

Functional elements	Description
PT5	
Lac O	
Col E1	
MCS	
RBS	
6 xHis	
Ampicillin	

(4)

(5)

※作答時勿超過此線