

國立彰化師範大學 102 學年度碩士班招生考試試題

系所： 生物技術研究所

科目： 分子生物學

☆請在答案紙上作答☆☆

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一、單選擇題，選出最好的答案(each 2%)

1. A molecule that consists of a piece of DNA from one organism combined with the DNA from a member of another species is called _____.
(a) transgenic DNA (b) restricted DNA (c) recombinant DNA
(d) bioengineered DNA (e) mutant DNA
2. Which of the following best describes the composition of chromatin?
(a) DNA + protein (b) RNA + protein (c) purified DNA
(d) DNA + RNA (e) protein + antibodies
3. Which of the following macromolecules can be analyzed by Southern blotting?
(a) antibodies (b) amino acids (c) proteins (d) RNA (e) DNA
4. How are interactions between DNA binding proteins and short oligonucleotides detected using an electromobility shift assay (EMSA)?
(a) Through a shift in molecular weight of the oligonucleotide.
(b) Through activation of lacZ expression (assayed by the presence of a blue precipitate).
(c) Through survival of yeast cells on media lacking the amino acid histidine.
(d) Through purification of the protein-oligonucleotide complex with an antibody that specifically recognizes the DNA binding protein.
(e) None of the above
5. What is the role of *E. coli* dnaA in DNA replication initiation?
(a) unwinds the DNA (b) recognizes the site of replication origin
(c) removes the torsional DNA strand (d) binds to the single strand DNA
(e) all of the above
6. A piece of foreign DNA was inserted into a plasmid with an antibiotic resistance gene and a lac Z gene. The plasmid DNA was cut with a restriction enzyme, which splits the lac Z gene and opens the circle. The foreign DNA was next inserted into the open restriction site of the plasmid. When the recombinant plasmid was introduced into bacterial cells and grown in the presence of antibiotic, some of the colonies turned blue in the presence of X-gal. The blue colonies contained:
(a) plasmid only (b) foreign DNA only
(c) foreign DNA and restriction enzyme (d) recombinant DNA
(e) neither plasmid nor foreign DNA
7. In the above problem (#6), colonies that were white in the presence of X-gal contained:
(a) plasmid only (b) foreign DNA only
(c) foreign DNA and restriction enzyme (d) recombinant DNA
(e) neither plasmid nor foreign DNA

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8. Which following mechanisms was proven by the Meselson-Stahl experiment ?
 - (a) DNA polymerase has a crucial role in DNA synthesis.
 - (b) DNA synthesis in *E. coli* proceeds by a conservative mechanism.
 - (c) DNA synthesis in *E. coli* proceeds by a semiconservative mechanism.
 - (d) DNA synthesis requires dATP, dCTP, dGTP, and dTTP.
 - (e) Replication initiation requires a primer.
9. In cloning experiments, enzyme that cleaves DNA at sequence-specific sites is called _____.
 - (a) restriction endonuclease
 - (b) ligase
 - (c) sticky ends
 - (d) cDNA
 - (e) multiple cloning site
10. Luciferase assays can be used as a quantitative measure to determine which of the following?
 - (a) dynamics of protein-protein interactions
 - (b) strength of transcriptional activators
 - (c) residence time of a DNA binding protein at an enhancer element
 - (d) dynamics of protein degradation and/or protein stability
 - (e) copy number of the plasmid
11. *In vivo*, the direction of DNA synthesis is from _____.
 - (a) 5' to 3'
 - (b) 3' to 5'
 - (c) both 5' to 3' and 3' to 5'
 - (d) neither 5' to 3' nor 3' to 5'
 - (e) free hydroxyl end
12. Expression vectors are used for _____.
 - (a) DNA sequencing
 - (b) produce protein products
 - (c) chromosome synthesis
 - (d) site-directed mutagenesis
 - (e) generating restriction maps
13. Telomerase is important to eukaryotic cells because _____.
 - (a) the leading strand of DNA causes the telomeres to shorten
 - (b) telomeres attach to MTOC during cell division.
 - (c) telomerase digests telomeres to proper length.
 - (d) telomerase ensures the length of telomeres in each cell division
 - (e) telomerase activates cyclin B for cell cycle progression.
14. The polymerase chain reaction is used to:
 - (a) speed the rate of DNA replication in cells
 - (b) copy protein into RNA
 - (c) create millions of copies of an interesting piece of DNA
 - (d) make more copies of DNA polymerase
 - (e) make RNA in the cell nucleus

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15. A cDNA library is made from mRNAs and contains _____.
(a) only the protein encoding genes (b) promoter region (c) 5'UTR and 3' UTR
(d) RNA only (e) a and b
16. In central dogma, a process from RNA to protein is called _____.
(a) replication (b) transcription (c) translation (d) reverse transcription (e) transfection
17. Which of the following protein is **NOT** a subunit in holoenzyme of *E.coli* RNA polymerase?
(a) α (b) β (c) β' (d) γ (e) σ
18. Which item is prokaryotic core promoter element?
(a) Pribnow box (b) TATA box (c) GC box (d) CCAAT box (e) None of the above
19. Which subunit is active site in *E.coli* RNA polymerase holoenzyme where phosphodiester bond are formed?
(a) α (b) β (c) β' (d) γ (e) σ
20. How many RNA polymerases in most eukaryotic cells?
(a) 1 (b) 2 (c) 3 (d) 4 (e) None of the above
21. Which item is **NOT** belongs to eukaryotic core promoter elements?
(a) TFIIB recognition elements (BRE) (b) TATA box
(c) Downstream promoter elements (DPE) (d) Initiators
(e) -10 box
22. Which item is **NOT** major component in translation?
(a) DNA
(b) mRNA
(c) tRNA
(d) rRNA
(e) initiation factors, elongation factors and termination factors
23. Which item contains anti-codon?
(a) DNA (b) mRNA (c) tRNA (d) rRNA (e) None of the above
24. tRNA charging means tRNA can be bound by which molecule?
(a) glucose (b) fatty acid (c) nucleic acid (d) amino acid (e) citric acid
25. During prokaryotic translation initiation, which ribosome site can be bound by the initiator N-formyl-Methionyl-tRNA ?
(a) A site (b) P site (c) E site (d) Both A and P site (e) Both A and P and E site

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26. Which item play an important role during prokaryotic mRNA recognition & alignment by the smaller ribosomal subunit involves rRNA-mRNA pairing?
- (a) start codon sequence (b) poly(A) sequence (c) Shine Dalgarno sequence
(d) 3' untranslated sequence (e) 23S rRNA sequence
27. During translation, peptide bond formation is catalyzed by peptidyl transferase, what kind molecule is it?
- (a) DNA (b) RNA (c) protein (d) lipid (e) None of the above
28. Which item is a stop codon?
- (a) UTT (b) UAA (c) UGG (d) UCC (e) UUU
29. Which item is used to process and chemically modify rRNAs?
- (a) siRNA (b) miRNA (c) snRNA (d) snoRNA (e) scaRNA
30. Transgenic organism is also called _____?
- (a) GAS (b) CAS (c) GMP (d) GMO (e) cGMP

二、問答題：

1. You need to make a 50mL DNA binding buffer (500mM Tris, 3% glycerol, 100mM MgCl₂, 0.01 mg/ml BSA, 1M glucose) for your experiment on protein interactions with DNA. Below are listed of some reagents that you have in the lab. How would you make this solution?(10%)

Reagents available:
1M Tris
20% glycerol
0.5M MgCl ₂
2.5mg/mL BSA
glucose (MW = 180.2)

2. Please list **three major steps** in a PCR reaction and describe the major function of each process.(10%)
3. Please describe the general transcription factors needed for transcription initiation by eukaryotic RNA polymerase II. (5 %)
4. How to produce “clone sheep” ? (5%)
5. How to produce “gene knockout mice” ? (5%)
6. Please design a pair of primer and list the sequence which can be used to PCR for cloning full-coding region of following gene. (5%)

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TCGAGCGGCCGCCCGGGCAGGTGTCAGC

29 ATG GTG AAC AAG GCC GTT TGT GTG CTT AAA GGC ACC GGT GAA GTG ACC GGC
1 M V N K A V C V L K G T G E V T G

80 ACC GTC TAT TTC AAT CAA GAG GGT GAA AAG AAG CCA GTG AAG GTG ACT GGT
18 T V Y F N Q E G E K K P V K V T G

131 GAA ATT ACT GGC CTT ACT CCA GGA AAA CAT GGT TTC CAC GTC CAT GCC TTT
35 E I T G L T P G K H G F H V H A F

182 GGT GAC AAC ACA AAC GGC TGC ATC AGT GCA GGT CCG CAC TTC AAC CCT CAT
52 G D N T N G C I S A G P H F N P H

233 GAC AAA ACT CAT GGT GGG CCA ACC GAT AGT GTT AGA CAC GTC GGA GAC CTG
69 D K T H G G P T D S V R H V G D L

284 GGT AAT GTG ACC GCT GAT GCC AGT GGT GTT GCA AAA ATT GAA ATC GAG GAT
86 G N V T A D A S G V A K I E I E D

335 GCA ATG CTG ACT CTG TCA GGC CAA CAT TCT ATT ATT GGG AGG ACC ATG GTG
103 A M L T L S G Q H S I I G R T M V

386 ATT CAT GAG AAG GAG GAT GAC TTG GGG AAG GGT GGC AAT GAG GAA AGT CTA
120 I H E K E D D L G K G G N E E S L

437 AAA ACT GGC AAC GCT GGT GGT CGT CTG GCT TGT GGA GTG ATC GGC ATC ACT
137 K T G N A G G R L A C G V I G I T

488 CAG TGAATCTGCTCTAATGGAAGAGCCGGTTGAAATATTGGTGACCAATGTGGATGCCTCTGAAGCA
154 Q *