

所別：生命科學系碩士班 不分組 科目：分子生物學

I. Single Choice (39%)

- Which genome does **not** follow Chargaff's rule?
(a) Human (b) Rat (c) *Drosophila* (d) *Saccharomyces cerevisiae* (e) *E. coli* (f) Bacteriophage ϕ X174.
- Which method is **not** normally used for assaying DNA-protein interactions?
(a) filter binding (b) gel mobility shift (c) Southern blot (d) DNase footprinting (e) dimethylsulfate (DMS) footprinting (f) yeast one-hybrid test
- Which description is **incorrect** about a cloning vector?
(a) It carries a replication origin (b) It carries at least a selection marker, usually an antibiotic resistance gene (c) It usually carries a variety of unique restriction sites into which foreign DNA can be inserted (d) λ phage vectors can accommodate inserts up to 20 kb and are useful for building genomic libraries (e) Cosmids can accommodate inserts up to 50 kb (f) λ phage vectors can produce single-stranded recombinant DNA for DNA sequencing and site-directed mutagenesis.
- Which description is **incorrect** about PCR (polymerase chain reaction)?
(a) It includes 3 basic steps: denaturation, annealing, and extension (b) Each cycle doubles the number of DNA molecules (c) The extension temperatures are usually between 72 and 74 °C (d) Two single-stranded oligonucleotides complementary to sequences on either side of the region are needed (e) The most commonly used DNA polymerase in PCR is Klenow fragment (f) PCR was invented by Kary Mullis and his colleagues in the 1980s.
- Which method **cannot** be used for mapping RNA transcripts?
(a) Western blot (b) S1 nuclease mapping (c) Primer extension (d) 5' or 3' RACE (rapid amplification of cDNA ends) (e) Run-off transcription (f) RNase mapping
- Choose the **incorrect** description about transcription initiation in *E. coli*
(a) σ factor stimulates initiation, but not elongation, of transcription (b) σ factor can be re-used by different core polymerases (c) The core polymerase, not σ factor, governs rifampicin sensitivity or resistance (d) Prokaryotic promoters contain two consensus regions centered at -10 and -35 bp upstream of the translation start site (e) The consensus sequence at the -10 region has the sequence TATAAT (f) In general, the more closely resemble the consensus sequences, the stronger that promoter will be.
- Choose the **incorrect** description about transcription termination in *E. coli*
(a) Rho-independent terminators have an inverted repeat that allows a hairpin to form at the end of the transcript (b) A string of weak rU-dA base pairs at the end of the transcript holds the transcript to the template strand (c) A transcript derived from the DNA sequence 5'-TACGAAGTTCGTA-3' can form a hairpin (d) Rho-dependent terminators consist of an inverted repeat (e) Rho-dependent terminators have no string of Ts in the nontemplate strand (f) The *trp* attenuator serves as an excellent model of rho-dependent termination.
- Choose the **incorrect** description about the *lac* operon
(a) All the 3 structural genes in the *lac* operon are expressed from one promoter, yielding a polycistronic message (b) These 3 genes are turned on and off together (c) The *lac* operon is activated only when glucose concentration is low and lactose concentration is high (d) The CAP-cAMP complex inhibits transcription of the *lac* operon (e) Allo lactose acts as an inducer by binding to the repressor and causing a conformational shift that encourages dissociation from the operator (f) Cohn and colleagues demonstrated that a genetically defined constitutive *lac* operator has lower than normal affinity for the *lac* repressor.
- Choose the **incorrect** description about the *trp* operon
(a) Tryptophan acts as an inducer for the *trp* operon (b) The operon contains the genes for the enzymes that *E. coli* needs to make tryptophan (c) Under conditions of tryptophan starvation, the ribosome stalls at the tandem tryptophan codons in the leader transcript (d) Attenuation causes premature termination of transcription of the operon (e) Attenuation similar to the *trp* operon occurs only in prokaryotes (f) The concentration of glucose has no direct effect on the transcription of the *trp* operon.
- Choose the **incorrect** description about phage λ
(a) Phage λ can replicate in *E. coli* in either of two ways: lytic or lysogenic (b) In the lytic mode, almost all of the phage genes are transcribed and translated (c) In the lysogenic mode, the λ DNA is incorporated into the host genome and only the *cl* repressor gene is expressed (d) *cII* and *cIII* together stimulate transcription of *cl* from the P_{RM} promoter (e) *cro* is an immediate early gene, which codes for a repressor of the *cl* gene (f) *N* is an immediate early gene, which codes for an antiterminator that overrides the terminators after the *N* and *cro* genes.
- Which description about eukaryotic RNA polymerases is **wrong**?
(a) Eukaryotic nuclei contain 3 RNA polymerases (b) RNA polymerase I is found in the nucleolus (c) RNA polymerase II is found in the nucleoplasm (d) RNA polymerase I makes pre-tRNA and 5S rRNA (e) RNA polymerase II makes hnRNA and therefore is ultimately responsible for mRNA synthesis (f) At very low concentrations, α -amanitin inhibits polymerase II completely, while having no effect at all on polymerase I.
- Which of the following elements is **not** involved in transcription of eukaryotic genes?
(a) a TATA box (b) a GC box (c) a CCAAT box (d) an initiator (e) a downstream element (f) a Shine-Dalgarno sequence.
- Choose the **correct** one about the genetic code
(a) A single aa-tRNA recognizes only one codon (b) There is only one codon each for Met and Trp (c) Codon-anticodon pairing involves wobbling at the third position of the anticodon (d) G in 3rd position of anticodon pairs with C or U in 1st position of codon (e) Modifications occur in all parts of the tRNA molecule, except the anticodon loop (f) According to wobble hypothesis, at least 3 tRNAs are required for each codon family.

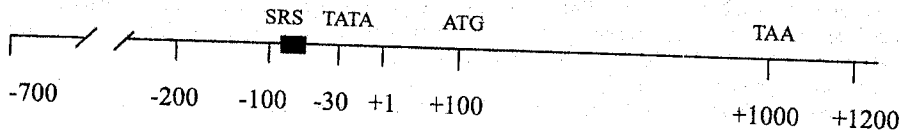
注：背面有試題

參考用

所別：生命科學系碩士班 不分組 科目：分子生物學

II. Questions (61%)

- How does the CTD (carboxyl-terminal domain) of RNA Polymerase II differ between (6%):
 - Its state when it enters the preinitiation complex?
 - Its state during promoter clearance?
 - What amino acids in the CTD make this transition possible?
 - Name two enzyme activities that are required to facilitate this transition.
- List and describe the functions of seven components of the eukaryotic spliceosome. (7%)
- Describe mechanisms for RNA interference (RNAi). (5%)
- You have sequenced the portions of the plant gene shown below (SRS = sugar response sequence; putative binding site for a transactivator protein):



- Identify the site or the smallest range over which the following elements would be found. (3%)

Minimal promoter	_____ to _____
Open reading frame	_____ to _____
DNA binding for upstream activators	_____
DNA binding for general transcription factors	_____
Potential site of EST sequence alignments	_____ to _____
Introns	_____ to _____

You construct a series of 5' promoter deletions linked to luciferase (Luc), introduce them into plant cells, and obtain the following data:

Construct	Units of luciferase expression		
	control (with sugar)	induced (without sugar)	fold induction
-700-Luc	400	6000	15
-200-Luc	400	6000	15
-100-Luc	400	6000	15
-30-Luc	200	200	1
no DNA	0	0	-

- How would you determine if DNA-binding proteins interact with SRS? Include a brief description of the experimental methods you would use, including the DNA constructs and the type of the results you would obtain if such factors were detected. (3%)
 - List the different classes of DNA-binding domains found in eukaryotic transcription factors. (3%)
 - List the different classes of DNA activity domains found in eukaryotic transcription factors. (3%)
- What is CpG island? (5%)
 - Which protein triggers the SOS system and how? (5%)
 - Eukaryotic DNA replicates once per cell cycle. How do eukaryotic cells control rereplication? (9%)
 - How does a retrovirus RNA convert to a provirus? What are the difference between the structure of the LTRs in genomic retroviral RNAs and retroviral proviruses? (12%)

參考用