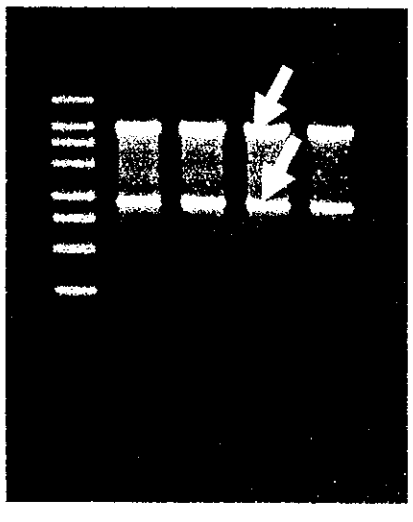
(一)選擇題 皆為單選題 ※ 注意：請於試卷內之「選擇題作答區」依序作答。
單選題 **45% (3% for each)**

1) Mature mRNA is generated from primary RNA transcripts through the specific removal of parts of the molecule, followed by re-joining of the retained parts. What is this process called?
A) Transposition
B) Splicing
C) Transcription
D) Translation
E) Retro transcription

2) Which of the following DNA sequence pairs are completely complementary?
A) 5'-CTGACCTGG and 5'-GGTCCAGTC.
B) 5'-TTGATGACC and 5'-TTGATGACC.
C) 5'-AGTCTTAGC and 5'-GCTAAGACT.
D) 5'-GAGCTAATA and 5'-GAGCATTAT.
E.)5'-GTCTATCAG and 5'-CTGATAGTC.

3) Which of the following sets of codons would you recognize as the end of the coding sequence within a genomic DNA sequence[i.e., they are "nonsense" (stop) codons] in humans and *Escherichia coli*?
A) AUG, UGA, UAA
B) TCA, TTA, CTA
C) ATG, ATC, ATA
D) UGA, UAA, UAG
E) TAG, TAA, TGA

4) When an RNA gel is ran, two major bands appear in the gel (as arrows in the below photo). What are they?



A) mRNA
B) tRNA
C) rRNA
D) gRNA
E) xRNA

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5) A gene normally expresses a 150-amino acid-long protein. A point mutation occurs in the coding DNA of this protein, resulting in the production of an abnormal protein with 121 amino acids. What is this mutation type referred to as?
A) A silent mutation.
B) A nonsense mutation.
C) A missense mutation.
D) Conversion of a stop codon into Methionine codon.
E) Insertion of three nucleotides in the promoter region.

6) Which of the following experiments can be used to analyze RNA expression levels?
A) Southern blotting
B) Western blotting
C) Immuno-staining
D) Northern blotting
E) None of the above

7) Which of the following is NOT an example of epigenetic regulation?
A) Methylation of histones
B) A point mutation of the enhancer regions
C) Methylation of cytosines within promoter regions
D) Binding of noncoding RNAs to promoter regions
E) Conversion of heterochromatin to euchromatin

8) In eukaryotes, which of the following general transcription factors binds to the TATA box?
A) TFIIA.
B) TFIIB.
C) TFIID.
D) TFIIE.
E) TFIIF.

9) If 3 restriction sites are cut in circular DNA, how many DNA fragments will be produced?
A) 1
B) 2
C) 3
D) 4
E) 5

10) To synthesis a small RNA like gRNA in a cell, what kind of RNA polymerase should be used?
A) DNA polymerase
B) RNA polymerase I
C) RNA polymerase II
D) RNA polymerase III
E) All of above

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11) cDNA is synthesized from RNA by which enzyme?
A) DNA polymerase
B) DNA synthetase
C) DNA kinase
D) Reverse transcriptase
E) All of above

12) Which enzyme is known to play a role in cell death?
A) Caspase
B) phosphatase
C) DNA topoisomerase
D) Reverse transcriptase
E) All of above

13) At which pH is RNA most stable?
A) pH 3-4
B) pH 4-5
C) pH 5-6
D) pH 7-8
E) All of above

14) The ratio of absorbance at 260 nm and 280 nm is used to assess the purity of DNA and RNA. Which of the below values indicates
the purest 260/280 ratio of DNA?
A) 1.0
B) 1.3
C) 1.8
D) 2.2
E) 3.2

15) For real time qPCR, which of the below Ct values (Cts) indicate the greatest abundance of the target nucleic acid?
A) Cts < 20
B) Cts of 25-30
C) Cts of 30-35
D) Cts of 35-38
E) Cts of 38-40

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(二) 簡答題 **55%** ※ 注意：請於試卷內之「非選擇題作答區」標明題號依序作答。

答題時回答要點，再闡述要點細節。可用簡圖與簡明敘述輔助作答。

以中文或英文作答皆可

16) When you designing a pair of primers for a PCR reaction, how many nucleotides are typically included in each primer and why? (How many nucleotides = 5%; Why = 5%)

17) Briefly describe how ATP is produced in mitochondria. (4%)

18) What are the three most common forms of each "post-transcriptional" and "post-translational "reaction? (6%)

19) For RNA modification, Ψ is derived from uridine via a base-specific isomerization reaction called pseudouridylation. How can pseudouridine be applied to vaccine production? (5%)

20) Design two RNA sequences for the small peptide Met-Ala-GLy-Ser-Asn-Ala-Val-Lys-Gly-Stop, via reference to the below table. (6%) Then design one 20 nucleotide length siRNA to target one of these RNA sequences with 3 nucleotide mismatches in the 3′ end (4%)

Second letter

First letter	U	C	A	G	
U	UUU Phe UUC Phe UUA Leu UUG Leu	UCU Ser UCC Ser UCA Ser UCG Ser	UAU Tyr UAC Tyr **UAA Stop** **UAG Stop**	UGU Cys UGC Cys **UGA Stop** UGG Trp	U C A G
C	CUU Leu CUC Leu CUA Leu CUG Leu	CCU Pro CCC Pro CCA Pro CCG Pro	CAU His CAC His CAA Gln CAG Gln	CGU Arg CGC Arg CGA Arg CGG Arg	U C A G
A	AUU Ile AUC Ile AUA Ile AUG Met	ACU Thr ACC Thr ACA Thr ACG Thr	AAU Asn AAC Asn AAA Lys AAG Lys	AGU Ser AGC Ser AGA Arg AGG Arg	U C A G
G	GUU Val GUC Val GUA Val GUG Val	GCU Ala GCC Ala GCA Ala GCG Ala	GAU Asp GAC Asp GAA Glu GAG Glu	GGU Gly GGC Gly GGA Gly GGG Gly	U C A G

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21) For restriction enzyme digestion, 'sticky end' and 'blunt end' enzymes are used. What is 'sticky end' and 'blunt end' digestion? (5%)

22) How can DNA and RNA be degraded? (DNA = 5%; RNA = 5%)

23) In relation to protein translation, explain the main reaction for each A site, P site and E site of the ribosome. (5%)

試題隨卷繳回