

一、是非題 (40 分，每題 2 分。請以“T”表示正確、以“F”表示錯誤，請直接將答案填於試卷上每題題號後的括弧內，不可以用鉛筆作答，答案若經塗改則不計分。)

1. () Interrupted conjugation results in the production of Hfr strains.
2. () The order of gene transfer is not the same for different Hfr strains.
3. () Ribose sugars have a hydroxyl on the 2' carbon.
4. () The pyrimidine bases in nucleic acids are cytosine, thymine, and uracil.
5. () There are three phosphates between each sugar in a molecule of DNA.
6. () Covalent bonds connect nucleotides in a strand; noncovalent interactions hold strands into a double-stranded structure.
7. () Direction of DNA synthesis in the lagging strand is different from the direction in the leading strand.
8. () DNA polymerases always synthesize new DNA by adding nucleotides on to the 5' phosphate.
9. () Eukaryotic cells use the same DNA polymerase to replicate mitochondrial, chloroplast, and nuclear DNA.
10. () A promoter is a sequence where DNA replication is initiated.
11. () In transcription, all parts of the DNA molecule are transcribed into RNA.
12. () RNA molecules have the same 5' to 3' orientation as the DNA template strands to which they are complementary.
13. () The 5' and 3' untranslated regions (UTRs) of processed mRNA molecules are derived from introns.
14. () Transcription and translation take place simultaneously in bacterial cells.
15. () All eukaryotic genes contain an intron.
16. () In eukaryotes, genes for rRNA and tRNA are usually present within tandem repeats.
17. () Like nucleic acids, polypeptides have polarity.
18. () The codon for methionine appears only at the beginning of the mRNA for a protein, not in the middle or in the end.
19. () A special tRNA that does not have an attached amino acid binds to stop codons to terminate translation.

20.() Synthesis of DNA does not takes place in meiosis I.

二、 選擇題 (30 分，每題 2 分。請自選項(a)~(e)中選取正確的選項。於試卷上每題題號後的括弧內，填入正確選項的英文字母代號。不可以用鉛筆作答，答案若經塗改則不計分。)

1. () In gene mapping experiments using generalized transduction, bacterial genes that are cotransduced are (a) on different bacterial chromosome (b) close together on the bacterial chromosome (c) far apart on the bacterial chromosome (d) on a plasmid.
2. () *leu⁻* bacteria are mixed in a flask with *leu⁺* bacteria, and soon all bacteria are *leu⁺*. However, if the *leu⁻* cells are on one side of a U-tube and the *leu⁺* cells are on the other, the *leu⁻* cells do not become prototrophic. This suggests: (a) conjugation (b) transformation (c) transduction.
3. () How are Hfr strains of bacteria different from F⁺ strains? (a) Cells of Hfr strains are able to transfer chromosomal genes, whereas cells of F⁺ strains cannot. (b) Cells of Hfr strains cannot initiate conjugation with F⁻ cells. (c) The F factor is integrated into the bacterial chromosome in all or most cells of an Hfr strain but in only a few cells in an F⁺ strain. (d) Cells of Hfr strains carry F' plasmids, whereas F⁺ cells do not. (e) Cells of Hfr strains can initiate conjugation with F⁺ cells or other Hfr cells.
4. () You perform interrupted-mating experiments on three Hfr strains (A, B, and C). Genes are transferred (from last to first) in the following order from each strain: strain A, thi-his-gal-lac-pro; strain B, azi-leu-thr-thi-his; strain C, lac-gal-his-thi-thr. How are the F factors in these strains oriented? (a) B and C are oriented in the same direction. (b) A and C are oriented in the same direction. (c) A and B are oriented in the same direction. (d) All of them are oriented in the same direction.
5. () If a DNA molecule is 30% cytosine, what is the percentage of guanine? (a) 30% (b) 35% (c) 65% (d) 70%.
6. () If the sequence of one strand of DNA is 5'-GCTAGCGTCG-3', what is the sequence of the complementary strand? (a) 5'-GCTAGCGTCG-3' (b) 5'-GCTGCGATCG-3' (c) 5'-CGACGCTAGC-3' (d) 5'-CGATCGCAGC-3'
7. () Which one of the following statements regarding eukaryotic transcription is *not* true? (a) Eukaryotic transcription involves a core promoter and a regulatory promoter (b) A group of genes is transcribed into a polycistronic RNA (c) Chromatin remodeling is necessary before certain genes are transcribed. (d) There is no one generic promoter
8. () Anticodons are found on _____ molecules. (a) rRNA (b) tRNA (c) mRNA (d) none of above answers.

9. () Which class of RNA is most abundant in cells? (a) rRNA (b) tRNA (c) mRNA (d) none of above answers.
10. () Which would not be found on an mRNA molecule? (a) Protein-coding region (b) 5' untranslated region (c) Promoter (d) Start and stop codons (e) 3' untranslated region
11. () To translate an mRNA requires two other types of RNA. These are: (a) tRNA and mRNA (b) tRNA and miRNA (c) tRNA and rRNA (d) rRNA and siRNA.
12. () The genetic code is said to be “degenerate” because: (a) there are more codons than amino acids (b) there are more amino acids than codons (c) different organisms use different codons to encode the same amino acid (d) some codons specify more than one amino acid.
13. () The genetic code is universal except for: (a) prokaryotes, which use a different genetic code than eukaryotes (b) a few mitochondrial genes, which substitute one sense codon for another (c) viruses, which use an entirely different genetic code (d) archaebacteria, which have their own genetic code.
14. () What is the minimum number of different aminoacyl-tRNA synthetases required by a cell? (a) 64, one for each codon (b) 61, one for each sense codon (c) 30, one for each different tRNA (d) 50, one for each different tRNA (e) 20, one for each amino acid.
15. () Through wobble, a single _____ can pair with more than one _____. (a) anticodon, codon (b) group of three nucleotides in DNA, codon in mRNA (c) tRNA, amino acid (d) codon, anticodon.

三、問答題 (30 分，每題 10 分。)

1. Please draw a 'transcription unit' and its corresponding translation regions on a genomic DNA sequences. You need to label the following terms on this DNA sequences: (1) promoter regions; (2) protein-coding region; (3) terminator; (4) start codon; (5) RNA transcription region; (6) introns; (7) exons; (8) directions of RNA transcribing; (9) direction of DNA templates; (10) 5'UTR & 3'UTR. You are allowed to add more annotations to make your answer clearly. (10 points)

2. Please write down the polypeptide sequences for each of three reading frames of the following DNA sequence, and indicate the amino and carboxyl ends of the polypeptide. (Note: the following DNA sequences is only one DNA sequence. Please use three-letter or single letter abbreviations of amino acids to write down the polypeptide sequences.)

AAAGAATGGG AAAAAGTTTG AAGCTTCGGT TCTCCAGAGT TATTGCTTCT TTCAATTCGT
GCCGTTCGAA AAACCCTTCT TCTCTTCCCC AAAATCCTAA TTTCTTCCCA CATAAGCTCA

3. Please describe Seymour Benzer's experiment for fine-structure analysis of bacteriophage genes. Your answers need to include following parts: (1) genetic materials and their expected phenotypes (2) The experimental design & expected results (3) how the experimental results lead to the conclusion to deduce the fine-structure of bacteriophage genes.