

本試題是否可以使用計算機：可使用，不可使用（請命題老師勾選）**SIMPLE-CHOICE QUESTIONS 單選題**

(Identify the correct statement. Gain two points for each correct question. 每題 2 分)

1. The error rate of the replication in bacteria is about \_\_\_\_\_ per gene per generation.  
(A)  $10^{-4}$   
(B)  $10^{-5}$   
(C)  $10^{-6}$   
(D)  $10^{-7}$
2. The mutation rate in any base pair is about 1 in \_\_\_\_\_.  
(A)  $10^6-10^7$   
(B)  $10^7-10^8$   
(C)  $10^8-10^9$   
(D)  $10^9-10^{10}$
3. Which nucleotide can pair with BrdU?  
(A) A  
(B) T  
(C) G  
(D) C
4. Which of the following species has the genes with least introns?  
(A) human  
(B) fly  
(C) yeast  
(D) mouse
5. Which of the following nucleotides is methylated in GATC repeats of bacterial *oriC*?  
(A) A  
(B) T  
(C) G  
(D) C
6. Which of the following statements is wrong regarding chromosome?  
(A) Centromeres are consisted of conserved repetitive DNA sequence in organisms.  
(B) Telomeres are consisted of simple repeating sequences in organisms.  
(C) Telomerase is a ribonucleoprotein enzyme.  
(D) Telomerase confers reverse transcription activity.

(背面仍有題目,請繼續作答)

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7. Which of the following statements is not correct regarding nucleosomes?
- (A) It consists of ~200 bp of DNA and octamer of histone proteins.
  - (B) DNA is wrapped around the outside surface of the protein octamer.
  - (C) Two copies of each core histones H1, H2, H3, and H4 form an octamer core.
  - (D) Micrococcal nuclease can trim nucleosomes to core particles which the length of DNA is reduced to 146 bp.
8. Which of the following statements is not correct regarding retrotransposon?
- (A) A retrotransposon is a transposon that mobilizes via RNA form.
  - (B) The difference between retrotransposon and retrovirus is that only retrovirus can exist extracellularly.
  - (C) Retrotransposon is present only in mammalian cells.
  - (D) Both retrotransposon and retrovirus can promote the genome rearrangement.
9. Which of the following statements is not correct regarding mismatch repairing systems in *E. coli*?
- (A) There is a bias in the selection of which strand to replace at the mismatches.
  - (B) The strand lacking methylation at a hemimethylated DNA duplex is usually replaced.
  - (C) The strand having methylation at a hemimethylated DNA duplex is usually replaced.
  - (D) The *mut* genes encode for a mismatch repairing system.
10. Which of the following statements is not true regarding antibody diversity?
- (A) Light chains form a single family, and heavy chains fall into the lambda and kappa families.
  - (B) Each chain has a variable region (V) and constant region (C).
  - (C) The genes coding for an intact immunoglobulin chain are generated by somatic recombination to join a V gene with a C gene.
  - (D) Somatic mutation enhances the diversity of immunoglobulin.
11. What is the cause of mating type switching in yeast?
- (A) DNA methylation
  - (B) RNA splicing
  - (C) Transposon
  - (D) Recombination
12. Which of the following statements is incorrect?
- (A) In prokaryotes, transcription is coupled to translation.
  - (B) In eukaryotes, RNA splicing occurs after the mRNA is transported into the cytoplasm.
  - (C) RNA splicing requires the formation of a spliceosome.
  - (D) Both prokaryotic and eukaryotic mRNAs are synthesized by RNA polymerase.

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13. Operon, a transcriptional unit in bacteria, consists of:
- (A) a promoter region, an operator region, and one or more regulatory genes.
  - (B) a promoter region, an operator region, and two or more structural genes.
  - (C) cis-acting elements adjacent to trans-acting factors.
  - (D) RNA polymerase loading zones.
14. DNA binding by proteins with the helix-turn-helix (HTH) motif does **not** involve
- (A) interactions with base pairs in the major groove of DNA.
  - (B) interactions with the sugar-phosphate backbone of DNA.
  - (C) hydrogen bonds, salt bridges, and van der Waals contacts.
  - (D) melting of the DNA at the center of symmetry.
15. Which of the following statements describes the similarity of mRNA in eukaryotes to that in prokaryotes?
- (A) The 5' ends of the primary transcript are triphosphorylated.
  - (B) The 5' ends become capped with 7-Methyl G.
  - (C) A polyA tail is added to the 3' end.
  - (D) The RNAs are spliced to form mature mRNA.
16. The "closed complex" at bacterial promoters
- (A) is in equilibrium with free RNA polymerase and the promoter.
  - (B) is not affected by promoter mutations.
  - (C) is bound more tightly when repressors are present.
  - (D) is not affected by activator proteins.
17. During transcription initiation, the template DNA strands are separated ("melted") from about positions
- (A) -35 to +1 after chain initiation.
  - (B) -9 to +2 after chain initiation.
  - (C) -35 to +1 prior to chain initiation.
  - (D) -9 to +2 prior to chain initiation.
18. In regulation by repression:
- (A) a sugar, such as lactose, acts as an inducer and combines with the repressor to prevent transcription.
  - (B) an inducer activates the activator so that it binds to DNA and prevents transcription.
  - (C) an amino acid activates the repressor so that the repressor binds to the operator and prevents transcription.
  - (D) an amino acid binds to the operator, blocking the repressor, allowing transcription to proceed.

(背面仍有題目,請繼續作答)

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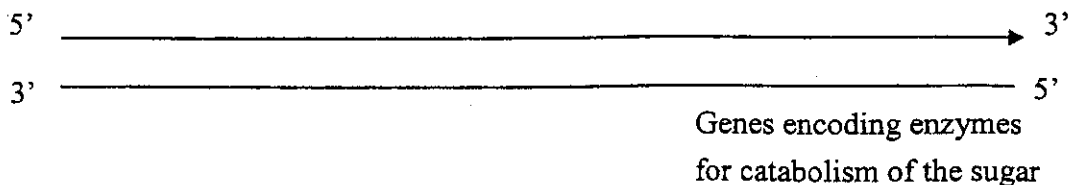
19. Which of the following features is *not* common to all tRNAs?
- (A) All have the same number of nucleotides.
  - (B) All have an anticodon sequence.
  - (C) All have an acceptor arm.
  - (D) All have a "cloverleaf" secondary structure.
20. Which of the following statements is *not* a feature of ribosomes?
- (A) All ribosomes are composed of RNA and protein.
  - (B) All ribosomes have one large subunit and one small subunit.
  - (C) The cytoplasmic and organellar ribosomes of eukaryotes are identical.
  - (D) Ribosomes interact with both mRNA and tRNA.
21. tRNA wobble is primarily a result of \_\_\_\_\_ codon-anticodon base pairing.
- (A) C·A
  - (B) C·U
  - (C) G·A
  - (D) G·U
22. Which of the following statements is correct for slippery sequences?
- (A) Slippery sequences are abnormal in all eukaryotic, prokaryotic, and viral genomes.
  - (B) Slippery sequences allow a ribosome to slip one codon forward or backward during translation.
  - (C) Slippery sequences result from mutations that reduce tRNA binding affinity.
  - (D) Slippery sequences allow more than one polypeptide to be coded by a single gene.
23. Which of the following genes does *not* belong to oncogene?
- (A) sis
  - (B) abl
  - (C) c-myc
  - (D) RB
24. Which of the following features is *not* common to G protein functions?
- (A) Gs stimulates adenylyl cyclase.
  - (B) Gi inhibits adenylate cyclase.
  - (C) Go opens Ca<sup>2+</sup> channels.
  - (D) Gq activates phosphodiesterase C $\beta$ .
25. Which of the following features is *not* common to Ras protein?
- (A) Ras is a monomeric G protein that is active when bounds to GTP.
  - (B) When GTP is hydrolyzed, the conformation of Ras changes.
  - (C) SOS is the Ras-GEF that inhibits Ras by causing GDP to be replaced with GTP.
  - (D) Ras-GAP is the protein that triggers the GTPase activity and deactivates Ras.

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本試題是否可以使用計算機：可使用，不可使用（請命題老師勾選）**SHORT ESSAY 簡答題** (Five points for each question. 每題 5 分)

1. Which organelles in cells contain genetic information?
2. Describe an example of application of the short repeat unit in genome (or called tandem repeat), e.g., satellite DNA.
3. Please draw and briefly describe the synthesis of Okazaki fragment.
4. Please draw and briefly describe the composite transposons (composite elements) in bacteria? What is the major force to support the transposition of composite transposon?
5. What general types of mutational damage may trigger DNA repair systems? What are the possible factors to cause DNA damage?
6. Please explain how a mutation in an intron section could affect the expression of that gene?
7. Below is an illustration of a hypothetical operon encoding the enzymes needed for catabolism of a sugar (e.g. sucrose, a disaccharide). Suppose the following: (1) transcription of the operon is positively regulated, (2) the sugar acts as the inducer, and the bacterium is being grown in a medium that contains the sugar. Add each of the following to the drawing:  
The sugar  
RNA polymerase  
The regulatory protein that is controlling this operon  
Binding sites for the regulatory protein and RNA polymerase  
Whether or not transcription is occurring (recall that the medium contains the sugar)



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8. Compare the structures of prokaryotic and eukaryotic mRNAs.
9. Please explain why the mRNAs need to be capped and polyadenylated at 5' and 3' ends respectively in eukaryotic cells?
10. Please describe how the p53 protein regulates the cell cycle progression and the cellular apoptosis?