所有考題皆爲單選題，考生應作答於『答案卡』。每題 2 分，總分 100 分。

1. Telomerase
(A) creates a short DNA sequence complementary to the DNA template.
(B) creates a short RNA sequence complementary to the DNA template.
(C) creates a short DNA sequence complementary to the RNA template.
(D) solves the end replication problem in the leading strand.

2. Which of the following enzymes will produce a blunt end (the cut site is indicated by the * in the recognition sequence)?
(A) *Taq*I (T*CGA)
(B) *Eag*I (C*GGCCG)
(C) *Eco*RV (GAT*ATC)
(D) *Nsi*I (ATGCA*T)

3. DNA primase
(A) creates a short RNA primer complementary to the RNA template.
(B) creates a short DNA primer complementary to the RNA template.
(C) creates a short DNA primer complementary to the DNA template.
(D) creates a short RNA primer complementary to the DNA template.

4. The lagging strand is replicated with stretches of Okazaki fragments and that is why its synthesis is considered to be
(A) discontinuous.
(B) primed.
(C) never stopping.
(D) semiconservative.

5. A scientist developed a particular chemical to bind with adenine. If this chemical were applied prior to the S phase in the cell cycle, what might be a logical prediction of the outcome?
(A) The DNA replication would proceed except that adenine would have the chemical bound to it and is incorporated into the new sister chromatids.
(B) The DNA replication would proceed except that everywhere an adenine was supposed to be, a thymine was substituted into the new developing strand.
(C) The DNA replication would proceed because cytosine and guanine would continue to form base pairs.
(D) The DNA replication would stop because if adenine was bound then thymine would not have a complement with which to base pair.

6. As the two strands of DNA are unraveled, an enzyme relieves the strain on the two strands. The enzyme is
(A) DNA polymerase III.
(B) DNA polymerase I.
(C) DNA helicase.
(D) DNA gyrase.
(E) DNA ligase.

7. Which of the following enzymes removes the primers used for DNA replication?
(A) DNA polymerase I
(B) DNA polymerase II
(C) DNA polymerase III
(D) DNA ligase

8. If you were able to look very closely at a portion of DNA and find methylated histones, you would
(A) be mistaken since only DNA can be methylated, not histones.
(B) be looking at a region of active chromatin.
(C) be looking at a region of inactive chromatin.
(D) be looking at transcription initiation.

9. A mutation in one gene that counteracts the effects of a mutation in another gene is known as a
(A) temperature-sensitive mutation.
(B) recessive mutation.
(C) conditional mutation.
(D) suppressor mutation.

見背面

10. You are studying the function of a recently identified gene in *C. elegans*. You have been performing genetic screens for several months in an attempt to isolate loss-of-function mutations in this gene, but unfortunately you have been unsuccessful. Your advisor suggests that you try another approach to eliminate gene function. Which of the following techniques would accomplish this goal?
(A) Design a repressor to bind to the operon of this gene.
(B) Use a histone deacetylase to induce a transcriptionally inactive state.
(C) Use a *C. elegans* strain with a homozygous TFIID mutation to prevent the translation initiation complex from forming.
(D) Use RNA interference to prevent mRNA translation.

11. Which of the following statements regarding the ubiquitin-proteosome pathway is false?
(A) This pathway is used to regulate expression of a number of cell surface receptors.
(B) When proteins are destroyed by the proteosome, the ubiquitin moiety is not destroyed, but rather cleaved off and reused.
(C) Ubiquitin ligase adds ubiquitin residues to targeted proteins in a stepwise fashion.
(D) Ubiquitination of a targeted protein requires only one molecule of ATP.

12. The p300/CBP (CREB-binding protein) coactivator proteins are histone acetyltransferases that help regulate the transcription of many genes. Based on this information, these proteins are involved in
(A) DNA acetylation.
(B) chromatin remodeling.
(C) recruitment of RNA polymerase II.
(D) formation of the transcription initiation complex.

13. The polymerase chain reaction (PCR) technique can be used for
(A) direct isolation of a specific segment of genomic DNA.
(B) preparation of probes.
(C) synthesis of RNA from genomic DNA.
(D) a and b
(E) all of the above

14. In the large-scale production of a particular human protein in *E. coli* cells, the cDNA corresponding to the protein was modified so that the expressed protein would have six histidine residues at the C-terminus. The purpose of this modification was
(A) to facilitate transfer of the cDNA into the *E. coli* cells.
(B) to provide a promoter for the transcription of the cDNA in *E. coli*.
(C) to facilitate purification of the expressed protein though binding to an affinity column.
(D) to prevent degradation of the expressed protein by *E. coli* proteases.

15. The ability of DNA to denature is important for which process?
(A) DNA synthesis
(B) nucleic acid hybridization experiments
(C) RNA synthesis
(D) all of the above

16. Which of the following is not required for both DNA replication and RNA transcription?
(A) DNA
(B) primers
(C) RNA
(D) proteins

17. Which of the following lead(s) to a point mutation?
(A) deamination of a cytosine base into a uracil base in the open reading frame
(B) A change from a TAA codon to a TAG codon in the coding region
(C) A sequence change in the 3' untranslated region
(D) A loss of a T in the coding region
(E) all of the above

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18. You are performing an experiment to assay phosphorylation of a substrate by a protein kinase. Based on the data in the table below, what do these experimental results suggest?

	Substrate	Protein kinase	GTP	Phosphorylation detected
Test sample	+	+	+	yes
Control #1	-	+	+	no
Control #2	+	-	+	yes
Control #3	+	+	-	no

(A) GTP is not required for phosphorylation.
(B) The substrate can undergo autophosphorylation.
(C) The substrate is not required for phosphorylation.
(D) The protein kinase is required for phosphorylation.

19. Sorting of protein to mitochondria and chloroplasts is
(A) cotranslational.
(B) post-translational.
(C) pretranslational.
(D) quasitranslational.

20. Protein X contains seven transmembrane domains, with a short N-terminus and a long C-terminus. Following protein synthesis, the N-terminus of the protein faces the lumen (the inside) of the endoplasmic reticulum (ER). After protein X is transported to the cell surface via exocytosis, you would expect the C-terminus of the protein X to be
(A) extracellular.
(B) cytoplasmic.
(C) in the lumen of ER.
(D) in the lipid bilayer of the plasma membrane.

21. The genetic material of which kind of cells is included in a single, circular molecule of DNA?
(A) bacteria
(B) yeasts
(C) flies
(D) flowering plants

22. Kinases, which are responsible for the activation or inactivation of a number of proteins, can add phosphate groups onto
(A) tryptophan residues.
(B) tyrosine residues.
(C) cysteine residues.
(D) a and c.
(E) none of the above

23. The dissociation constant (K_d) of the human serotonin receptor for serotonin is 1×10^{-10} M. What does this mean?
(A) It means that when the concentration of the serotonin receptor is 1×10^{-10} M, half of the available serotonin receptor sites are occupied.
(B) It means that when the concentration of the serotonin receptor is 1×10^{-10} M, all of the available serotonin receptor sites are occupied.
(C) It means that when the concentration of serotonin is 1×10^{-10} M, all of the available serotonin receptor sites are occupied.
(D) It means that when the concentration of serotonin is 1×10^{-10} M, half of the available serotonin receptor sites are occupied.
(E) None of the above

24. Which of the following sequential order for the secretory pathway is false?
(A) Rough endoplasmic reticulum (ER) → ER-to-Golgi transport vesicles → Golgi cisternae → secretory vesicles.
(B) Rough ER→ ER-to-Golgi transport vesicles → Golgi cisternae → Mitochondria.
(C) Plasma membrane → Early endosome → Late endosome → Lysosome.
(D) Rough ER→ ER-to-Golgi transport vesicles → Golgi cisternae → Late endosome → Lysosome.

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25. The first step in the secretory pathway that should be inhibited by a dominant-negative mutant of SNARE proteins is
(A) rough endoplasmic reticulum to Golgi transport.
(B) intra Golgi transport.
(C) trans Golgi network (TGN) transport to the plasma membrane.
(D) TGN transport to the late endosome.

26. Which of the following statements about tRNA is correct?
(A) There are 61 different types of tRNAs.
(B) Stop codons are recognized by specialized tRNAs.
(C) Aminoacyl-tRNA is formed by joining the amino group of an amino acid to a tRNA.
(D) The amino acid residue, instead of the anticodon, determines the specificity of an aminoacyl-tRNA.
(E) Each tRNA folds into a unique structure for codon recognition.

27. What is a Shine-Dalgarno sequence?
(A) It is a pyrimidine-rich stretch.
(B) It is complementary to the 3'-end of the 23S ribosomal RNA.
(C) It is usually followed by a stop codon.
(D) It usually forms a stem-loop structure.
(E) It is located at the 5' UTR.

28. An enhancer
(A) is a protein that binds to RNA polymerase and stimulates transcription.
(B) is a metabolite that stimulates transcription of eukaryotic promoters.
(C) interacts with repressor proteins to enhance transcriptional activity.
(D) acts as a binding site for RNA polymerase.
(E) none of the above.

29. Which of the following statements regarding RNA splicing is correct?
(A) It is an important mechanism for translational regulation.
(B) It usually occurs in both prokaryotes and eukaryotes.
(C) It requires GTP, instead of ATP, as the energy source.
(D) It may produce different mRNA sequences from the same gene.
(E) None of the above.

30. Which of the following statements on ribosome is correct?
(A) Its molecular weight is about 100 KDa.
(B) The RNA component contributes more to the mass than does the protein component.
(C) The catalytic core is consisted of proteins.
(D) It hydrolyzes ATP during reaction.
(E) None of the above

31. Which of following events does not occur within the nucleus?
(A) protein phosphorylation
(B) RNA capping
(C) polyadenylation
(D) splicing
(E) ribosomal RNA synthesis

32. Which of the following techniques is generally used to detect DNA-protein interactions?
(A) SDS-PAGE
(B) in situ hybridization
(C) electrophoretic mobility shift assay
(D) Southern blotting
(E) yeast two-hybrid system

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33. Which of the following statements regarding microRNAs is correct?
(A) They are commonly found in all living cells.
(B) Base-pairing to the target mRNA is not perfect.
(C) Expression of ~5% of human genes is controlled by microRNAs.
(D) Most of them contain a poly(A) tail.
(E) One microRNA recognizes only one mRNA, but one mRNA can be bound by more than one microRNA.

34. Self-splicing introns
(A) use ATP as the energy source.
(B) are found mainly in pre-mRNA.
(C) function through a single trans-esterification reaction.
(D) are a type of ribozymes.
(E) use calcium ions as a cofactor.

35. Which of the following statements regarding ribosome reading frames is correct?
(A) There are two possible reading frames for a given mRNA sequence.
(B) A reading frame defines an amino acid sequence.
(C) The ribosome may read mRNA in the 5' to 3' or in the 3' to 5' direction.
(D) The ribosome will always follow the same reading frame during translation.
(E) The ribosome may follow a reading frame composed of di- or tri-nucleotides.

36. How does the interaction between the lac repressor and the lac operator block transcription initiation?
(A) lac repressor binding blocks RNA polymerase from interacting with DNA at the start site.
(B) lac operator induces a conformational change in lac repressor.
(C) lac repressor binding causes a conformational change in RNA polymerase.
(D) lac operator blocks DNA polymerase from interacting with the transcription start site.
(E) lac repressor binding induces a protease that degrades the sigma subunit of RNA polymerase.

37. Which of the following statements about the essential carboxyl terminal domain (CTD) of RNA polymerase is NOT true?
(A) The CTD can bind different factors.
(B) The CTD can become phosphorylated.
(C) The CTD is present in RNA polymerase I, II, and III.
(D) The CTD is critical for viability.
(E) The CTD may contain many repeats of a heptapeptide.

38. Which of the following is not a structural motif found in a DNA-binding domain?
(A) stem-loop
(B) zinc-finger
(C) helix-loop-helix
(D) leucine-zipper
(E) homeodomain

39. Where do transcription and translation occur in prokaryotic cells?
(A) on the plasma membrane
(B) in the nucleus
(C) in the cytoplasm
(D) in the nucleus and then in the cytoplasm
(E) in the cytoplasm and then in the nucleus

40. Proteins that bind to DNA and turn on operons by making it easier for RNA polymerase to bind to a promoter are called
(A) promoters.
(B) operators.
(C) activators.
(D) inducers.
(E) enhances.

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41. A typical eukaryotic cell may contain tens of thousands of genes, but only a small fraction of them are expressed at the same time. In this case,
(A) the default state of most genes is usually set to be on.
(B) the default state of most genes is usually set to be off.
(C) most un-expressed genes are deleted from the genome.
(D) most expressed genes are copied several times.
(E) most expressed genes are joined together.

42. Splice sites in pre-mRNA are marked by two universally conserved sequences contained
(A) in the middle of the intron.
(B) in the middle of the exon.
(C) at the ends of the exons.
(D) at the ends of the introns.
(E) one in the intron and the other in the exon.

43. Which type of RNA participates in nuclear export of mRNA?
(A) snRNA
(B) miRNA
(C) snoRNA
(D) tRNA
(E) hnRNA

44. Synthesis of pre-rRNA occurs in the
(A) cytoplasm.
(B) endoplasmic reticulum.
(C) extranucleolar area of the nucleus.
(D) nucleus.
(E) nucleolus.

45. If the third base of a codon is U, which of the following bases on the first position of an anticodon is usually NOT allowed?
(A) A
(B) G
(C) I
(D) U
(E) any bases are allowed.

46. Active mTOR stimulates the overall rate of protein synthesis in the cell. Which of the following can activate mTOR?
(A) presence of stress
(B) presence of growth factors
(C) low nutrients
(D) low energy
(E) none of the above

47. Lipid soluble hormones activate transcription by
(A) binding to a nuclear receptor.
(B) phosphorylating a protein kinase.
(C) binding to specific cell-surface receptors.
(D) inhibiting a histone deacetylase.
(E) none of the above.

48. Which of the following RNA is NOT produced by RNA polymerase II?
(A) rRNA
(B) mRNA
(C) snRNA
(D) miRNA
(E) none of the above.

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49. Which of the following sequences functions as a promoter for transcription?
(A) TATA box
(B) initiator
(C) CpG island
(D) all of the above
(E) none of the above

50. Eukaryotic mRNA can be degraded in the cell through the following pathways, EXCEPT
(A) decapping.
(B) poly(A) shortening.
(C) endonucleolytic cleavage.
(D) restriction digestion.
(E) exonucleolytic cleavage.

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