

Please choose the most appropriate terms/phrases/statements that complete or answer the questions.

Attention: More than one of the choices provided may be correct.

(2.5 points for each question)

1. Regarding to telomerase which statements is (are) CORRECT?
 - (A) It contains an RNA
 - (B) It contains a DNA
 - (C) It contains a protein
 - (D) It contains a DNA-dependent DNA polymerase
 - (E) It contains an RNA-dependent DNA polymerase
2. Regarding to cell cycle which statements is (are) CORRECT?
 - (A) Cell cycle can be promoted by protein degradation
 - (B) Kinases control key events
 - (C) Most of the kinases involved in cell cycle are tyrosine kinases
 - (D) CDK is the major kinase
 - (E) G1 and G2 do not exist in bacteria
3. Which abbreviations of amino acid are hydrophilic?
 - (A) K
 - (B) W
 - (C) D
 - (D) G
 - (E) S
4. Regarding to translation which statements is (are) CORRECT?
 - (A) It requires ATP.
 - (B) It requires GTP.
 - (C) eIF2 binds to the CAP.
 - (D) eIF4 binds to the 40S.
 - (E) First codon is mainly AUG.
5. About splicing, which is (are) CORRECT?
 - (A) Trans-splicing contains an intron from other mRNA
 - (B) U1 binds to the branch site
 - (C) U2 binds to the 5' splicing site
 - (D) U4/U5/U6 promote bending of intron
 - (E) The ligation step is achieved by the transesterification reaction.
6. About double strand break repair, which is (are) NOT CORRECT?
 - (A) Ku is a single strand binding protein
 - (B) MRE11 is a double strand binding protein
 - (C) ATR senses double strand breaks
 - (D) BRCA1 promotes strand transfer
 - (E) DNA ligation is a required step
7. RNA Pol II can transcribe the following genes:
 - (A) tRNA
 - (B) rRNA

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- (C) ncRNA
(D) mRNA
(E) Actin
8. About DNA replication, which is (are) NOT CORRECT?
(A) Origins contain repetitive sequences
(B) RPA is required for binding
(C) DnaB opens the double strand
(D) PCNA facilitates the movement of polymerase
(E) Topoisomerase solves the supercoiling stress
9. Regarding to mitochondria, which is (are) CORRECT?
(A) ATPase is at the intermembrane space
(B) Glucose converts to pyruvate therein
(C) TCA cycle occurs there
(D) ATP is generated by substrate-level acetylation
(E) The net change in standard free energy is positive.
10. Regarding to translation, which is (are) CORRECT?
(A) Hairpin at mRNA can leading to pausing of polymerase
(B) Factor binding at specific mRNA sites can block translation
(C) Ribosomes contain P and A sites.
(D) Bacteria mRNA contain Kozak sequence
(E) 80S ribosome usually recognizes a cap.
11. Which methods can be used to detect protein-protein interaction?
(A) Farwestern
(B) Yeast two hybrid
(C) Gel mobility shift
(D) Immunofluorescence
(E) Coimmunoprecipitation
12. Regarding to cell cycle, which is (are) CORRECT?
(A) Cyclin D expresses at M phase
(B) Separase cleavages condensin to separate 2 chromatids.
(C) P21 is a stress-induced inhibitor of CDK
(D) P27 expresses in G1 to keep cells in G0
(E) P53 is induced under stress to drive P27
13. Regarding to cancer, which is (are) CORRECT?
(A) PD1 expression level is critical for the success of the PD1 antibody-conducted immunotherapy.
(B) RB is a CDK inhibitor at G1
(C) RB binds the G1 cyclin D
(D) HIF1 α stabilization is critical for metastasis
(E) Telomerase expression is required for its maintenance
14. About mismatch repair, which is (are) CORRECT?
(A) MutS binds to the methylation site
(B) UvrB bends the DNA

- (C) UvrC cleavages the sites around the damage
- (D) Only one strand is repaired
- (E) The pathway is frequently damaged in liver cancer

15. Which methods can be used to change the expression of a wild-type gene?

- (A) Small interference RNA
- (B) Antisense RNA
- (C) MicroRNA
- (D) TALEN gene editing
- (E) CRISPR/Cas9 editing

16. About chromatin, which is (are) CORRECT?

- (A) Genes at heterochromatin is usually silent
- (B) Telomeric genes are highly expressed
- (C) Histone tails are usually highly methylated
- (D) H3K4 is an active mark
- (E) X chromosome is inactivated by a long non-coding RNA

17. About transcription, which is (are) CORRECT?

- (A) A transcriptional factor can bind to an enhancer which is far away from the promoter.
- (B) The TATA box is located at all promoters of RNA Pol II transcribed gene.
- (C) The TATA box is usually bound by a TATA box binding protein
- (D) Histone methylation opens chromatin
- (E) Histone acetylation opens chromatin

18. Which of the following factors is essential for mRNA maturation in eukaryotes?

- (A) TATA-box binding protein
- (B) Ribosome
- (C) 5'-capping complex
- (D) Spliceosome
- (E) RNA pol II polymerase

19. Which of the following sequence has the highest melting temperature?

- (A) Ggattc cctagg
- (B) Ggaccc cctagg
- (C) Ggaaac cctagg
- (D) Ggattc tttagg
- (E) Ggattc aatagg

20. Which of the following pathways need helicase?

- (A) DNA replication
- (B) Homologous recombination
- (C) Gene transcription
- (D) RNA splicing
- (E) RNA editing

21. Which of following statements for nucleic acid is (are) TRUE:

- (A) C, T are Purines
- (B) There are three hydrogen bonds between CG pairing

- (C) During the process of free nucleotides becoming RNA, every single nucleotide added, two phosphate groups are released.
- (D) The higher the GC content, the lower the T_m value is.
- (E) RNA at neutral pH buffer (pH=7) has no charge

22. What the followings are True when one design a set of primer for cloning:

- (A) Introducing extra sequences that would give us a restriction site in primer can be added at either 5' or 3' end of primer
- (B) Annealing temperature should only consider the sequence that could based paired with the target gene
- (C) Only if a N-terminus protein tag has been introduced into vector backbone, one should consider whether introduced restriction sites in the primer result in frame shift in the final protein products
- (D) Length of primer can be as short as 5 nucleotides
- (E) As long as melting temperature reaches to the target temperature, nucleotide composition is not affect the primer efficiency

23. Which of the following statements for mRNA is (are) TRUE:

- (A) Prior to 5' mRNA capping, there are three phosphate at 5' end of mRNA
- (B) Cap structure is dispensable for protein translation initiation in eukaryotic mRNA.
- (C) Poly(A) tail of the mRNA is encoded in the DNA sequence
- (D) One eukaryotic mRNA corresponding to one gene whereas one prokaryotic mRNA containing multiple gens.
- (E) RNA splicing is one of the first discovered enzymatic reaction that can be catalyzed by Ribozyme.

24. Which of the following statements is (are) TRUE:

- (A) tRNA are transcribed by RNA polymerase II
- (B) Pre r-RNA are transcribed by RNA polymerase I
- (C) mRNA are transcribed by RNA polymerase III
- (D) long noncoding RNA are transcribed by RNA polymerase III
- (E) microRNA precursors are transcribed by RNA polymerase II

25. For the statements of various biological processes in different cell compartments, which statement is (are) TRUE

- (A) Nucleolus is located in the nucleus
- (B) rRNA are made in the cytoplasm
- (C) RNA synthesis takes place in the cytoplasm
- (D) DNA replication takes place in nucleolus
- (E) Mitochondria has its own DNA

26. Which of the following amino acid residues has polar side chain:

- (A) Arginine
- (B) Asparagine
- (C) Phenylalanine
- (D) Lysine
- (E) Tryptophan

27. Which of following statement is (are) TRUE:

- (A) Hydrophobic means it is water-like
- (B) Nucleic acid dissolved in water is because it is a negatively charged molecule.
- (C) Sodium acetate solution can not neutralize the charge of nucleic acid

- (D) The principle of ethanol precipitation is based on nucleic acid is not able to dissolved in ethanol
(E) Most denatured proteins are water soluble
28. What of the following statements is (are) TRUE:
(A) Regardless Prokaryote or Eukaryote, ribosome is responsible for protein synthesis
(B) An actively translated mRNA often has one ribosome on the mRNA
(C) Eukaryote mRNA often forms in a circle to facilitate translation
(D) There is one three-nucleotide sequence corresponding to stop codon
(E) E site in ribosome responsible for polypeptide elongation
29. What of the following statements is (are) TRUE:
(A) Since there are 20 amino acids, there are 20 different tRNAs in the cell.
(B) Despite the sequence differences within all tRNAs, all tRNAs have very similar tertiary structure
(C) Only aminoacyl tRNA can be used in ribosome mediated polypeptide elongation.
(D) No enzyme is required for tRNA amino acid addition
(E) Upon tRNA is transcribed, tRNA can be used to incorporate amino acid
30. CRISPR is a famous genome-editing tool. Which of following statement is (are) TRUE:
(A) CRISPR is discovered as a bacterial immune system
(B) There are multiple types of CRISPR
(C) Two major components that introduced into mammalian cell for genome editing are cas-9 protein and guide DNA
(D) Creating gene deletion using CRISPR rely on the mistake of DNA repairing system in the host cell
(E) The recognition sequence for the cas-9 crispr system is the three nucleotide PAM sequence
31. There are 45 different kinds tRNA (anticodons) available to serve as amino acid carriers, but there are 64 mRNA codons. Why aren't the tRNA anticodons and mRNA codons equal in number?
(A) The reason is that some tRNA anticodons can misread some of the mRNA codons, which creates a "wobble" in the tRNA anticodons that can be repaired by RNA repair enzymes.
(B) The reason is that the third base pair on the mRNA codon allows some flexibility (wobble); thus, some tRNA anticodons can recognize more than one mRNA codon.
(C) The reason is that the third base pair on the tRNA allows some flexibility (wobble); thus, some tRNA anticodons can recognize more than one mRNA codon.
(D) The reason is that the tRNA has the flexibility to choose which mRNA codons are necessary for building the polypeptide chain.
(E) This broader recognition occurs because of the nonstandard pairing between bases in the wobble position corresponding to the 3' base in the mRNA and the complementary 5' base in the tRNA anticodon.
32. Which of the following describe the general mechanism of DNA synthesis is (are) TRUE?
(A) One strand is made 5' → 3', while the other strand is made 3' → 5' in short discontinuous segments.
(B) The strands become separated during synthesis.
(C) Synthesis occurs in one direction from the starting site of synthesis.
(D) Synthesis of DNA is a very accurate process.
(E) DNA is replicated by a semi-conservative mechanism.
33. A mutation that changes the recognition sequence for the restriction enzyme *EcoRI* from GAATTC to GATTC is an example of a
(A) restriction fragment length polymorphism (RFLP).
(B) single nucleotide polymorphism (SNP).

- (C) simple sequence repeat (SSR).
(D) genetic heterogeneity
(E) none of the above
34. Which of the following statement(s) about intracellular second messengers is (are) TRUE?
(A) It is a substance that brings about a desired effect in a cell as a result of a hormone binding to its receptor on the cell surface.
(B) It is a hormone that affects the DNA of the target cell.
(C) It is a specialized form of mRNA.
(D) Cyclic ATP can act as secondary messengers.
(E) Ca^{2+} can function as a secondary messenger by controlling the flow of Ca^{2+} into the cells.
35. Which of the following statement(s) about heterochromatin is (are) CORRECT?
(A) It is a region of condensed chromatin.
(B) It is a region without DNA replication.
(C) It is often simple sequence DNA.
(D) It is a dark-staining area of a chromosome.
(E) It is usually transcriptionally active.
36. The three dimensional structure of nucleic acids can include:
(A) Supercoiling
(B) Base stacking
(C) beads on a string
(D) Circular molecules
(E) Hairpin loops.
37. 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 RNA interference to prevent mRNA translation.
(D) Use a wild type strain and mutagenize it with a UV light.
(E) Use antisense DNA to block RNA transcription.
38. Which of the following statement(s) is (are) CORRECT?
(A) The DNA polymerases in eukaryotes have similar functions to those found in bacteria, but they are not identical.
(B) Thymine dimers are most often caused by ionizing radiation.
(C) The primase on DNA Polymerase α can make RNA structures only.
(D) Telomerase activity may decline with old age.
(E) Nicked segments of single-stranded DNA are linked by DNA ligase.
39. Which of the following statements concerning restriction endonucleases is (are) TRUE?
(A) They protect bacterial cells from invasion by viruses (bacteriophages).
(B) They attack RNA, not DNA.
(C) They attack single-stranded sequences only.
(D) They can produce "sticky ends".

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(E) They do not display sequence specificity in their site of attack.

40. When electrical current is applied during a gel electrophoresis procedure, the DNA fragments are separated by

- (A) electrical charge, positive on one side, negatives on the other.
- (B) the number of poly-A tails associated with each one.
- (C) their response to the staining chemicals used during the procedure.
- (D) the size of the fragments.
- (E) the enzyme binding activity sites.

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