PRACTICE QUESTIONS

1. Which of the following are functions of nucleosomes?

   I. Supercoil chromosomes
   II. Regulate transcription
   III. Store ribosomes

   A. I only
   B. I and II only
   C. II and III only
   D. I , II and III

2. Which of the following shows the correct function of each enzyme?

	Helicase	DNA Polymerase I	DNA Ligase
A.	Unwinds DNA and breaks hydrogen bonds between complementary bases	Adds nucleotides to the DNA strand	Links Okazaki fragments
B.	Adds nucleotides to the DNA strand	Unwinds DNA and breaks hydrogen bonds	Replaces the RNA primers
C.	Unwinds DNA and breaks hydrogen bonds between complementary bases	Replaces the RNA primers with DNA	Links Okazaki fragments
D.	Adds nucleotides to the DNA strand	Replaces the RNA primers with DNA	Unwinds DNA and breaks hydrogen bonds between complementary bases

3. During transcription, the nontranscribed strand is known as the:

   A. Sense strand
   B. Antisense strand
   C. Nonsense strand
   D. Activating strand

4. Splicing involves the removal of:

   A. Introns
   B. Exons
   C. Genes
   D. Nucleosomes

5. Which of the following shows the correct direction of each process?

	Replication	Transcription	Translation
A.	5′ to 3′	5′ to 3′	3′ to 5′
B.	3′ to 5′	3′ to 5′	3′ to 5′
C.	5′ to 3′	3′ to 5′	5′ to 3′
D.	5′ to 3′	5′ to 3′	5′ to 3′

6. Which of the following is/are a function(s) of ribosomes attached to the rough endoplasmic reticulum?

I. Synthesizing proteins for export
II. Synthesizing proteins for use within the cell
III. Production of lysosomes

A. I only
B. I and II only
C. I and III only
D. I, II, and III

7. Which of the following help in regulating gene expression in eukaryotic cells?

A. DNA ligase
B. Transcription factors
C. Plasmids
D. Nucleotides

8. Which enzyme relieves tension on the DNA strand to allow helicase to work more efficiently?

A. DNA polymerase I
B. DNA ligase
C. DNA gyrase
D. DNA polymerase II

9. The process of translation occurs in the:

A. Cytosol
B. Nucleus
C. Cell membrane
D. Nucleolus

10. The term polysome refers to:

A. Many tRNA molecules attaching to a single ribosome.
B. Many mRNA molecules attaching to a single ribosome.
C. Many ribosomes attaching to a single mRNA molecule.
D. Many amino acids attaching to a single tRNA molecule.

11. Which of the following enzymes are needed for transcription of DNA?

I. DNA polymerase
II. Helicase
III. RNA polymerase

A. I only
B. I and II only
C. II and III only
D. III only

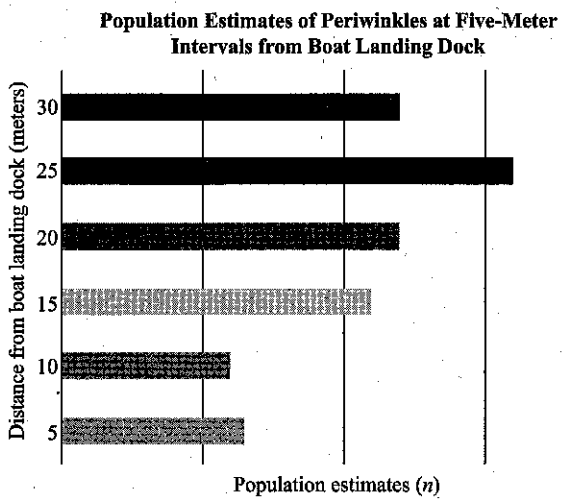
12. Posttranscriptional processing of eukaryotic RNA includes:

A. Addition of introns
B. Removal of introns
C. Addition of exons
D. Removal of exons

13. Which of the following statements is correct concerning prokaryotic and eukaryotic DNA replication?

A. DNA replication in prokaryotic cells is initiated at many sites, and eukaryotic replication is initiated at only one site.
B. DNA replication in eukaryotic cells is initiated at many sites, and prokaryotic replication is initiated at only one site.
C. Both prokaryotic and eukaryotic DNA replication occur in the nucleus.
D. Both prokaryotic and eukaryotic DNA replication occur in the cytosol.

14. The average population sizes of periwinkles inhabiting the marsh grass at a state park were calculated in 5-meter quadrants. Six population estimates were calculated at distances of 5, 10, 15, 15, 25, and 30 meters from the boat landing dock. The graph below shows the results of the population sampling.



(a) State the distance at which the greatest number of periwinkles was found. (1)
(b) Calculate the range for the mean population estimate of the periwinkles. (2)
(c) Suggest reasons for the distribution of periwinkles at the different intervals from the boat landing dock. (2)

15. Compare the roles of DNA polymerase I and DNA polymerase III. (2)

16. State 4 functions of proteins. Name an example of each. (4)

17. Outline splicing. (2)

18. (a) Draw tRNA. (4)
(b) Compare DNA and RNA. (4)
(c) Outline protein structure. (6)

ANSWERS EXPLAINED

1. **(B)** Nucleosomes supercoil chromosomes and help regulate transcription. Genes located in areas between nucleosomes are more easily transcribed than those wound around the nucleosomes (histones).

2. **(C)** Helicase unwinds DNA and breaks hydrogen bonds between the bases; DNA polymerase I replaces the RNA primers. DNA ligase forms phosphodiester bonds between Okazaki fragments.

3. **(A)** The sense strand is the nontranscribed strand.

4. **(A)** Splicing removes introns (non-coding regions) in eukaryotic cells.

5. **(D)** All processes run in a 5′ to 3′ direction.

6. **(C)** Ribosomes attached to the rough ER synthesize proteins for export and produce lysosomes.

7. **(B)** Transcription factors regulate the process of transcription.

8. **(C)** DNA gyrase relieves tension on the DNA strand in order to allow helicase to work more efficiently.

9. **(A)** Translation occurs in the cytosol of the cell.

10. **(C)** A polysome consists of many ribosomes translating off of a single mRNA strand.

11. **(D)** Only RNA polymerase is needed for transcription.

12. **(B)** Posttranscriptional processing of mRNA includes splicing, which is the removal of introns.

13. **(B)** DNA replication in eukaryotic cells is initiated at many sites, and prokaryotic replication is initiated at only one site.

14. (a) 25 meters (+/– 1) units required.
    (b) 32 – 12 = 20 range of periwinkles (+/– 2). The calculation must be shown.
    (c)
    - Less human intervention away from boat landing dock
    - Less pollution away from boat landing dock
    - Less disturbance from waves produced by boats
    - At the greatest distance, the population drop may be due to less turbulence in water, leading to less nutrient movement/change in soil and therefore resulting in lower levels of grass marsh

15.
    - DNA polymerase I replaces RNA primers with DNA.
    - DNA polymerase III lays down nucleotides, producing complementary strands.
    - DNA polymerase I replaces many more RNA primers on the lagging strand than on the leading strand.
    - Both enzymes are used during replication.

16.

Function of Protein	Example
Transport	Haemoglobin transports oxygen around the body.
Protection	Antibodies help destroy free antigens in the body.
Communication	Some hormones, such as insulin, help tissues communicate.
Movement	Actin and myosin in muscle cells function for movement.
Structural support	Keratin in skin and nails adds support and strength. Collagen helps support tissues.

17.

- Splicing involves the removal of introns from pre-mRNA to make mature mRNA.
- Splicing occurs in eukaryotic cells only/prokaryotic cells do not have introns.
- Splicing occurs after transcription but before mRNA leaves the nucleus.
- Introns are noncoding regions.

18. (a)

- One point is awarded for the correct cloverleaf shape
- 3′ end holding amino acid
- ATP energy for adding amino acid to 3′ end
- Anticodon on middle of cloverleaf as a triplet base
- 5′ and 3′ ends labelled correctly
- CCA as last triplet base pairs on 3′ end

(b)

- DNA is double stranded. RNA is single stranded.
- DNA contains the sugar deoxyribose. RNA contains the sugar ribose.
- DNA contains the bases adenine, thymine, cytosine and guanine. RNA contains the bases adenine, uracil, cytosine, and guanine.
- DNA codes for all the genes. RNA codes for one gene at a time.

(c)

- Proteins are composed of amino acids.
- Amino acids are joined together by peptide bonds.
- Chains of amino acids (polypeptides) are synthesized at the ribosome.
- Primary structure is a chain of amino acids held together by peptide bonds.
- Secondary structure involves the polypeptide forming alpha helixes or beta pleats.
- Secondary structure is due to hydrogen bonding.
- Tertiary structure forms when the secondary structure folds over on itself.
- Disulphide bonds are responsible for tertiary structure.

- R-groups determine the folding of proteins.
- Quaternary structure involves two or more polypeptides joining together due to many types of bonds.
- Quaternary structure may involve the addition of prosthetic groups.
- Award one point for naming an example of a protein with a quaternary structure (for example, haemoglobin).