Section 12–3 RNA and Protein Synthesis (pages 300–306)

This section describes RNA and its role in transcription and translation.

The Structure of RNA (page 300)
1. List the three main differences between RNA and DNA.
   a. RNA has ribose sugar instead of deoxyribose.
   b. RNA is generally single-stranded, instead of double-stranded.
   c. RNA contains uracil in place of thymine.

2. Is the following sentence true or false? RNA is like a disposable copy of a DNA segment. ________ true ________

3. What is the importance of the cell’s ability to copy a single DNA sequence into RNA?
   It makes it possible for a single gene to produce large numbers of RNA molecules.

Types of RNA (pages 300–301)
4. What is the one job in which most RNA molecules are involved? ________ Most are involved in __________
   protein synthesis. ________

5. Complete the compare-and-contrast table about the types of RNA.

<table>
<thead>
<tr>
<th>Type</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Messenger RNA</td>
<td>Carries copies of the instructions for assembling amino acids from DNA to the rest of the cell</td>
</tr>
<tr>
<td>Ribosomal RNA</td>
<td>Is a part of ribosomes</td>
</tr>
<tr>
<td>Transfer RNA</td>
<td>Transfers each amino acid to the ribosome to help assemble proteins</td>
</tr>
</tbody>
</table>

Transcription (page 301)
6. Circle the letter of each sentence that is true about transcription.
   a. During transcription, DNA polymerase binds to RNA and separates the DNA strands.
   b. RNA polymerase uses one strand of DNA as a template to assemble nucleotides into a strand of RNA.
   c. RNA polymerase binds only to DNA promoters, which have specific base sequences.
   d. Promoters are signals in RNA that indicate to RNA polymerase when to begin transcription.
RNA Editing (page 302)
7. Many RNA molecules from eukaryotic genes have sections, called **introns**, edited out of them before they become functional. The remaining pieces, called **exons**, are spliced together.

8. Is the following sentence true or false? RNA editing occurs in the cytoplasm of the cell. **false**

9. What are two explanations for why some RNA molecules are cut and spliced?
   a. It makes it possible for a single gene to produce several different forms of RNA.
   b. It may play a role in evolution, making it possible for small changes in DNA to have dramatic effects in gene expression.

The Genetic Code (pages 302–303)
10. Proteins are made by joining into long chains called **polypeptides**.

11. How can only four bases in RNA carry instructions for 20 different amino acids?
    The genetic code is read three letters at a time, so that each “word” of the coded message is three bases long.

12. What is a codon? It consists of three consecutive nucleotides that specify a single amino acid that is to be added to a polypeptide.

13. Circle the letter of the number of possible three-base codons.
    a. 4    b. 12  c. 64  d. 128

14. Is the following sentence true or false? All amino acids are specified by only one codon. **false**

15. Circle the letter of the codon that serves as the “start” codon for protein synthesis.
    a. UGA    b. UAA    c. UAG  d. AUG

Translation (pages 303–305)
16. What occurs during the process of translation? The cell uses information from messenger RNA to produce proteins.

17. Where does translation take place? Translation takes place on the ribosomes.
18. Circle the letter of each sentence that is true about translation.
   a. Before translation occurs, messenger RNA is transcribed from DNA in the nucleus.
   b. Translation occurs in the nucleus.
   c. It is the job of transfer RNA to bring the proper amino acid into the ribosome to be
      attached to the growing peptide chain.
   d. When the ribosome reaches a stop codon, it releases the newly formed polypeptide
      and the mRNA molecule.

19. What is an anticodon? The three bases on a tRNA molecule that are complementary to one of
    the mRNA codons.

20. ______ 20. Master plan
    ______ 21. Goes to the ribosomes in the cytoplasm
    ______ 22. Blueprint
    ______ 23. Remains in the nucleus

24. Many proteins are ______ enzymes, which catalyze and regulate chemical
    reactions.

25. Is the following sentence true or false? Genes are the keys to almost everything that
    living cells do. ______ false

The Roles of RNA and DNA  (page 306)

Match the roles with the molecules. Molecules may be used more than once.

<table>
<thead>
<tr>
<th>Roles</th>
<th>Molecules</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. 20. Master plan</td>
<td>a. DNA</td>
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<tr>
<td>b. 21. Goes to the ribosomes in the cytoplasm</td>
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<tr>
<td>b. 22. Blueprint</td>
<td></td>
</tr>
<tr>
<td>a. 23. Remains in the nucleus</td>
<td></td>
</tr>
</tbody>
</table>

Genes and Proteins  (page 306)

24. Many proteins are ______ enzymes, which catalyze and regulate chemical
    reactions.

25. Is the following sentence true or false? Genes are the keys to almost everything that
    living cells do. ______ false

Reading Skill Practice

A flowchart is useful for organizing the steps in a process. Make a flowchart that
shows the steps in the process of translation. Look at Figure 12–18 on pages 304–305
for help. For more information about flowcharts, see Appendix A. Do your work on
a separate sheet of paper.

Flowcharts should at least show the four major steps in translation as described in Figure 12–18 on
pages 304–305.