

***Introduction to Biotechnology, 3e (Thieman)***  
**Chapter 2 An Introduction to Genes and Genomes**

1) The complementary base that hydrogen bonds with thymine in a DNA double helix is

- \_\_\_\_\_.
- A) uracil
  - B) thymine
  - C) guanine
  - D) adenine
  - E) cytosine
- Answer: D

2) Which of the following is a structural feature of DNA but not RNA?

- A) Single-stranded
  - B) Containing the nitrogenous base adenine
  - C) Containing phosphate groups
  - D) Containing deoxyribose sugars
  - E) Containing the nitrogenous base uracil
- Answer: D

3) Which type of base-pair substitution mutation has no effect on the amino acid sequence of a protein?

- A) Missense mutation
  - B) Nonsense mutation
  - C) Silent mutation
  - D) Frameshift mutation
  - E) None of these choices
- Answer: C

4) Which of the following is a characteristic of smooth endoplasmic reticulum (SER) but not rough endoplasmic reticulum (RER)?

- A) Protein synthesis
  - B) Sending vesicles to the Golgi that contain proteins that are either secreted or become part of the plasma membrane
  - C) Steroid synthesis
  - D) Drug and alcohol detoxification
  - E) Steroid synthesis *and* drug and alcohol detoxification
- Answer: E

5) Which of the following enzymes is a component of the large ribosomal subunit and catalyzes the formation of peptide bonds between an amino acid attached to a peptidyl-tRNA and an amino acid from an aminoacyl-tRNA?

- A) Reverse transcriptase
- B) DNA polymerase
- C) Peptidyl transferase
- D) DNA ligase
- E)  $\beta$ -galactosidase

Answer: C

6) Addition of a poly(A) tail to an mRNA molecule \_\_\_\_\_.

- A) allows the mRNA to be recognized by ribosomes during translation
- B) allows mRNA molecules to be more stable in the cytoplasm
- C) results in removal of introns
- D) only occurs in bacteria
- E) is an important step in translation

Answer: B

7) What enzyme separates strands of DNA during DNA replication to make DNA single-stranded so it can be copied?

- A) DNA primase
- B) DNA polymerase
- C) DNA helicase
- D) DNA ligase
- E) Reverse transcriptase

Answer: C

8) \_\_\_\_\_ bind to mRNA and tRNA during translation and allow for polypeptides to be synthesized.

- A) Chloroplasts
- B) Ribosomes
- C) Nuclei
- D) RNA polymerases
- E) Chromosomes

Answer: B

9) \_\_\_\_\_ is the enzyme that copies DNA during DNA replication. Thermostable forms of this enzyme are essential for PCR.

- A) RNA polymerase
- B) DNA ligase
- C) DNA polymerase
- D) RNA primase
- E) DNA helicase

Answer: C

10) Which of the following is the typical start codon in most mRNA molecules?

- A) UGA
- B) AUG
- C) AAA
- D) GAA
- E) CAG

Answer: B

11) Which type of point mutation creates a stop codon in a gene?

- A) Nonsense
- B) Frameshift
- C) Silent
- D) Missense
- E) None of these choices

Answer: A

12) Nonprotein coding pieces of pre-mRNA that are removed during RNA splicing are called

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- A) introns
  - B) exons
  - C) SNPs
  - D) promoters
  - E) poly(A) tails

Answer: A

13) Which organelles form the site of ATP production by aerobic cellular respiration?

- A) Lysosomes
- B) Mitochondria
- C) Ribosomes
- D) Golgi
- E) Rough endoplasmic reticulum

Answer: B

14) Which type of RNA molecules transport amino acids to the ribosome during translation?

- A) rRNA
- B) tRNA
- C) siRNA
- D) mRNA
- E) miRNA

Answer: B

15) Which type of RNA molecule contains the genetic code of a gene that is read by ribosomes during translation?

- A) rRNA
- B) tRNA
- C) siRNA
- D) mRNA
- E) miRNA

Answer: D

16) In a nucleotide of DNA, which carbon of the deoxyribose sugar binds to the base?

- A) 1'
- B) 2'
- C) 3'
- D) 4'
- E) 5'

Answer: A

17) Which of the following sequences is most commonly found at eukaryotic promoters?

- A) TATAAT
- B) Poly(A) tail
- C) 7-methyl G cap
- D) 5'-GU . . . AG-3'
- E) Shine-Dalgarno sequence

Answer: A

18) Which of the following is the most commonly used stop codon in most mRNA molecules?

- A) UGA
- B) AUG
- C) AAA
- D) GAA
- E) CAG

Answer: A

19) What is synthesis of RNA from a DNA template called?

- A) Transformation
- B) Reverse transcription
- C) Transcription
- D) Translation
- E) None of these choices

Answer: C

20) Synthesis of a protein from an mRNA molecule is called \_\_\_\_\_.

- A) transcription
- B) translation
- C) transformation
- D) polymerization
- E) polyadenylation

Answer: B

21) What is the role of the Golgi apparatus in cellular function?

- A) Protein packaging
- B) Replication of DNA
- C) Protecting the integrity of the cell's shape
- D) Filling the cell space with fluid
- E) mRNA synthesis

Answer: A

22) Which is NOT true of prokaryotes?

- A) They contain ribosomes.
- B) Their cells contain a true nucleus.
- C) Their genes contain exons.
- D) They include bacteria.
- E) They are single-celled organisms.

Answer: B

23) Which of the following is NOT a function performed in the nucleus?

- A) Storing genes on chromosomes
- B) Producing regulatory factors
- C) Packaging proteins and transport them around the cell
- D) Producing mRNA
- E) DNA replication

Answer: C

24) Which part of a gene codes for the protein?

- A) Promoter
- B) Exon
- C) Intron
- D) Enhancer
- E) Transcription factor

Answer: B

25) Another term for a triplet code is \_\_\_\_\_.

- A) an enhancer
- B) a promoter
- C) tRNA
- D) a factor
- E) a codon

Answer: E

26) Why is mRNA a good intermediate for translation?

Answer: mRNA is a good intermediate because it must leave the nucleus and go to the cytoplasm to direct translation. DNA is the genetic code and cannot leave the nucleus and risk degradation. So, mRNA can carry the DNA information to the cytoplasm without causing any risk of harm to the original DNA molecule.

27) Give three differences between DNA and RNA.

Answer: DNA has the sugar deoxyribose and RNA has the sugar ribose. DNA has the base Thymine and RNA has the base Uracil in place of Thymine. DNA is double-stranded and RNA is single-stranded.

28) What is the difference between acquired and inherited mutations?

Answer: An acquired mutation is one that occurs in an organism after birth and throughout its life. It can be caused by, for example, too much exposure to radiation, which, over time, can cause a mutation or series of mutations that can lead to cancer. An inherited mutation is one in the germ line that can be passed from parent to offspring. For example, a person that has a gene that expresses a mutation for color blindness can be passed on from a parent to a child.

29) Briefly describe how the experiments performed by Frederick Griffith provided evidence of DNA as the genetic material.

Answer: Griffith used two strains of the bacteria *Streptococcus pneumoniae*. One strain caused disease, known as the S strain, and the other strain was a harmless strain called the R strain. When the S strain was injected into mice, the mice died; when the R strain was injected into mice, the mice lived. When Griffith heat-killed the S strain and injected it into mice, the mice then lived. However, when he injected heat-killed S and R strains together in mice, the mice died. Griffith showed that the S strain had transformed the R strain, causing it to become virulent and kill the mice.

30) Why is it beneficial for the genetic code to be redundant?

Answer: Because there are several codons that code for each amino acid, there can be mutations that occur that change one nucleotide in the codon but still result in the same amino acid being produced. Thus, not all mutations will cause disease or render the protein inactive.